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Entry-level job skills needed by wildlife management professionals

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ENTRY-LEVEL JOB SKILLS
NEEDED BY WILDLIFE MANAGEMENT PROFESSIONALS

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ABSTRACT

The research purpose was to identify the job skills needed by entry-level wildlife managers, which was accomplished by utilizing a Delphi panel of wildlife management experts from the academic, private and public employment sectors.

The Delphi panel was selected from a committee nominated, pool of 81 innovative wildlife management experts. The panel for Rounds One, Two, and Three of this Delphi survey consisted of 31, 32, and 31 members, respectively.

The Delphi process involved three survey rounds. Round One consisted of collecting and developing entry-level job skill items from the panel, which resulted in 382 items. Round Two developed initial consensus on the 382 items and developed two new items. Round Three finalized the consensus on the 384 entry-level job skill items.

In Round Three, the panel came to consensus on all 384 items with a minimum consensus rating of 80.6%, a maximum consensus rating of 100%. All entry-level job skill items were then ranked by level of importance. Seventy-two were ranked “high importance”, 175 were “substantial importance”, 123 were “moderate importance”, 14 were of “low importance”, and zero was of “no importance”. When skills were grouped by category, 108 were biological science skills, 54 were practical daily work skills, 49 were quantitative science skills, 42 were communication skills, 38 were policy administration skills, 35 were physical science skills, 31 were humanities skills, and 27 were basic statistics skills.

Based on the composition of the expert Delphi panel and the research results, the Delphi technique was a valid method for collecting geographically spread, consensual expert opinion to provide guidance for developing contemporary and futuristic wildlife management curricula at the university level.

CHAPTER 1

INTRODUCTION

Contemporary wildlife management is interwoven with science, management, and sociological issues (Thomas 2000). Embedded within this multi-dimensional paradigm is the sustainable development of limited natural resources. Furthermore, the base of human existence is biospheric stability, which depends upon the collaboration of professionals and stakeholders to wisely conserve finite natural resources. The wildlife management profession is based upon higher education degrees (Bachelor of Science, Master of Science, and Doctor of Philosophy). Higher education provides a formal learning atmosphere and is responsible for educing entry-level job skills, which is the emerging education paradigm (Tanner 2001). Therefore, to meet contemporary and futuristic needs, industry and educational leaders are collaborating to identify the educational needs of entry-level workers (Wilhelm 1999). Furthermore, technical skills are typically learned in a formal educational atmosphere, and technical skills support an organization's core competencies (Green 1999).

While much of the emphasis has been placed on secondary education (SCANS 1991), there is a growing demand for higher education to produce work-ready graduates. The Secretary's Commission on Achieving Necessary Skills (SCANS) identified skills and competencies that would afford workers personal and financial success, who become conscientious, contributing members of society (Wilhelm 1999). Higher education should have the same expectations to provide an education worthy of contemporary and futuristic values.

Higher education is responsible for educating and training future professionals to intelligently meld a mixture of curricula (i.e. liberal arts and science) to solve contemporary and futuristic issues. To meet this responsibility, higher education has developed and expanded natural resource curricula to integrate pertinent knowledge (Leopold 2000). Leopold (2000) suggests several factors that have adversely affected natural resource undergraduate programs.

1. recent reductions in undergraduate education budgets
2. high expectations of students and parents
3. increasing professional complexities
4. legislatively reduced college program hours
5. controversial learning importance of natural history versus advanced science
6. human and social demands in the global workforce
7. research requirements versus teaching needs.

However, the most important need of wildlife management Bachelor of Science graduates, the primary stakeholders of this research, is post-graduation, employment opportunity. Contemporary natural resource education focuses on academic learning more than hands-on management and practical field knowledge (Ledford 1996). Graduates applying for entry-level employment need experience in planting food plots, writing management plans, conducting surveys, operating equipment, and communicating effectively (Ledford 1996). Faculty should assess the knowledge of incoming and outgoing students, and employers should be surveyed to determine what assets recent graduates are lacking (Ledford 1996).

Wildlife management undergraduates have three broad fields of employment opportunity: 1) Academia (graduate school and research), 2) Private sector (natural resource industries, private land management, and consulting), and 3) Public sector (local, state, and federal government). A Delphi panel of wildlife experts was purposefully selected from these employment sectors to identify entry-level, wildlife management job skills. The Delphi panel is a research tool that collects expert opinions to provide judgment and wisdom about future needs when empirical data is not readily available (Coates 1975).

Purpose and Objective

The primary purpose of this research was to identify the job skills needed by entry-level wildlife managers. The research objective was accomplished by utilizing a Delphi panel of wildlife management experts from the academic, private and public employment sectors. This study was conducted to accomplish the following specific objective:

> To identify the job skills needed by entry-level wildlife managers as perceived by the Delphi panel of wildlife management experts.

Significance of the Study

Idealistically, a wildlife management undergraduate degree increases one's awareness and knowledge to benefit society. Realistically, a wildlife management undergraduate degree is a personal means to preferred employment and a better lifestyle. Pragmatically, successfully completing a wildlife management undergraduate degree program is a benefit to society, the wildlife management profession, and the degree recipient. The underpinning of this study is to enhance the employment opportunities for entry-level wildlife managers. While the Delphi panel of wildlife experts was not considered the primary stakeholder group, their expert opinions were utilized to develop a contemporary and futuristic list of entry-level, wildlife management job skills.

The primary premise is that an undergraduate wildlife management degree program, which embeds entry-level job skills identified by a Delphi panel of experts, will provide a quality undergraduate education. The secondary premise is that wildlife management undergraduates who acquire entry-level job skills in an undergraduate program will optimize their post-graduation employment opportunities. Therefore, embedding contemporary and futuristic entry-level job skills in a wildlife management undergraduate program is valuable to undergraduates, higher education institutions, the wildlife management industry, and society.

In the review of literature, many expert opinions have provided direction for wildlife management education and professional development. The expert opinions are chronologically representative of historic, contemporary, and futuristic demands of the wildlife profession. However, there is a compelling need for contemporary, innovative wildlife managers to construct a list of entry-level job skills to guide the higher education of young wildlife managers.

Herein is the value of a Delphi panel of expert opinion to forecast futuristic needs. The Delphi forecasting concept originated from ancient Greek pagan worship, which used oracles (soothsayers) to interpret the future and the preferences of the Gods (Encyclopedia Britannica 2002). The most famous oracle was Pythia, who forecasted the advice of Apollo concerning political outcomes and wars (Encyclopedia Britannica 2002). Pythia resided in the oracle of Delphi located on Mont Parnassus on the shores of the Corinthian Gulf (Encyclopedia Britannica 2002). Pythia's forecasting abilities were sought by lawmakers, colonists, and people of affluence.

Contemporarily, the Delphi allows the formal gathering of expert opinions without the need to gather the experts under one roof (Dalkey 1969, Delbecq, Van de Van, and Gustafson 1975, Wilhelm 2001). The experts participate anonymously in "structured communication" to build consensus related to their expertise (Linstone and Turoff 2002:3). Recent Delphi studies have been utilized, to promote student and parental health, nursing curriculum development training, competencies for 21st century plastering contractors, entry-level workplace skills and competencies, critical academic skills of community college graduates, and research and evaluation needs of distance education (Birch, O'Toole, and Kanu 1997, Mitchell 1998, Custer, Scarcella, and Stewart 1999, Wilhelm 1999, Larson and Wissman 2000, Rockwell, Furgason, and Marx 2000). A modified Delphi panel of three expert groups of wildlife managers (academia, public, and private) was used to develop a list of entry-level wildlife management job skills.

Definition of Terms

The following terms were operationally defined for use in this study.

Entry-level, job skills - Individual use of knowledge, skills, and tools that supports the organization’s core competencies for task completion, which are typically learned in a formal learning situation and are industry specific (Green 1999).

Wildlife management experts – Professional wildlife managers employed in one of three workforce sectors (academic, private or public) who are innovative and forward thinking in their approach to contemporary and futuristic wildlife management.

CHAPTER 2

REVIEW OF LITERATURE

This research utilized a Delphi panel of wildlife experts to identify contemporary and futuristic entry-level wildlife management job skills. The practical application is to embed these identified skills within an undergraduate wildlife management program, which enhances post-graduation employment opportunities in academic, private, and public sector workplaces. The literature discussed herein followed a chronological timeline that has provided suggestions for the material that should be learned in a wildlife management curriculum by various wildlife management experts (historic and contemporary). The review discusses a continuum of professional thoughts, professional development needs, and research focus. In order to focus the needs of this research, the review of literature begins in the early days of the 20th century and brings the reader forward to the contemporary trends in wildlife management.

The Beginnings

Until the conservation era of President Theodore Roosevelt, the intention of American wildlife management was to perpetuate wildlife as long as game resources would last, and hunting would eventually become a-thing-of-the-past (Leopold 1931:16). Game laws were a method of dividing-up dwindling resources. With the Roosevelt Conservation Doctrine, American wildlife conservation came into vogue.

> “The Roosevelt doctrine of conservation led American wildlife management in three basic respects: 1) it recognized outdoor resources as one integral whole, 2) it recognized conservation through wise use as a public responsibility, and their private ownership as a public trust, and 3) it recognized science as a tool for discharging that responsibility” (Leopold 1931:17).

Initially, the purpose of game management was to produce a crop at levels higher than naturally occurred for human consumption (Leopold 1931). With the forethought of Aldo

Leopold, the wildlife profession has evolved a land ethic, which pervades into every niche of wildlife conservation, preservation, and ecosystem stewardship (Knight 1996). Wildlife management has developed from single species management to contemporary holistic stewardship (Thomas 2000).

The wildlife professional must have an ecological aptitude, a willingness and ability to apply pure and applied biology, and by nature be a scientific investigator (Leopold 1931). Professional wildlife stewardship is the application of art, human resource management, practical experience, and science. Unfortunately, few people became enthusiastic about wildlife research because biology was structured to perpetuate the "professional research monopoly" (Leopold 1943:5). Leopold's opinion on wildlife research was to incorporate discovery and optimism in the amateur wildlifer in order to foresee the future (Leopold 1943).

The "best man" has the widest knowledge and abilities (Graham, Couch, Swanson, Pearson, Kelker, and Hendrickson 1945:324). Further discussion in Graham et al. (1945) indicated that wildlife managers should be multi-talented. Managers should recognize plant and wildlife forms, possess ecological knowledge, use special techniques such as mapping, sampling and tracking, administer laws, understand economics, and appreciate the role of human elements.

Cottam (1947) presented the prevailing criticisms of wildlife research: impractical research, poor design, poor theory development, researcher bias, lack of conclusion, and poor communications of results. According to Cottam (1947), the prognosis to improve research was prioritizing research needs, leadership development, systematic exploration, time management, cost accounting, real-time data management, publishing through critical review, and public relations.

Errington's (1948) eulogy to Leopold brought forth Leopold's land ethic as a technique to facilitate student understanding and enjoyment of the land. Leopold's belief was that wildlife is understood by considering the landscape as a whole (Errington 1948). Students should be taught to compose manuscripts carefully and revise repeatedly until the manuscript is smooth and simplicity is maximized. Finally, Leopold was fair and generous with his time to the point where he frequently endured hardship to support his students, albeit their work was always theirs (Errington 1948).

Leonard (1955) was asked to view his crystal ball to foretell the forthcoming needs in wildlife management. In his opinion, the utmost hurdle was public opinion, and that biologists needed to consider sociological, political, and economic aspects when researching a species niche.

> "We must not forget that we exist to serve people, that people are our most important resource, and that no resource has intrinsic value, but acquires value only as it is of use to people" Leonard (1955:5).

Leonard (1955) applauded the biometrical abilities of the younger men displacing his generation. However, he cautioned that graduating with contemporary college training does not allow one to practice without constantly questioning one's direction. Leonard (1955) advised younger men to persist, imagine, and constantly question in order to establish a true profession instead of a hopeful technology.

Schoenfeld (1957) encouraged wildlife professionals to study and develop public relations Wildlife managers should develop favorable climates of public opinion. Therefore, to be successful, managers should invest equal time and talent into the study and development of wildlife-human relations. It is only a matter of time before public relation classes are as integral to academic wildlife learning as zoology (Schoenfeld 1957).

Wildlife management is 90% people management and 10% wildlife management was a reoccurring theme of the 1950's (Lumsden 1957). Managers with excellent research findings were faced with traditional belief systems that did not transform easily. Managers were forced to develop techniques that would influence change (i.e. group discussions instead of formal educational lectures). Lumsden (1957:464) suggested that wildlife managers partner with sociologists "to study people as assiduously as they studied deer."

The Re-Birthing

The "Age of Ecology" (the 1960's) produced a revolution in human-wildlife relationships (Sheffer 1976:51). Two new concepts emerged from the ecology movement: 1) man is dependent upon and responsible for natural ecosystem stewardship, and 2) the living organisms have value other than consumptive use. While management for wildlife harvest continued, managers no longer principally served hunters and trappers. The new paradigm included the "whole-earth" philosophy, which would eventually develop into holistic management (Sheffer 1976).

Linear comprehensive management is the inclusion and measurement of all components, which includes public demand (Bailey 1982). In a perfect world, wildlife managers would have absolute knowledge. Linear, comprehensive wildlife knowledge is restricted by the nature, diversity, and complexity of wildlife populations and budgetary constraints (Bailey 1982). Bailey (1982) implied that wildlife management is an art in which science is applied. Therefore, wildlife biologists must creatively apply the scientific method (design, sampling, and statistics) to obtain meaningful results and the make compromises and value judgments during management processes (Bailey 1982).

University wildlife programs should implement the position of "conservation educator" in their faculty to educate secondary life science teachers (Adams and Thomas 1986:484). The Department of Wildlife and Fishery Sciences at Texas A & M adopted this recommendation, which increased the literature contributions of wildlife professionals, increased graduate employment opportunity, and created a network of wildlife education teachers (Adams and Thomas 1986).

The educating of wildlife biologists is a responsibility of the wildlife profession (Peek 1989). Conservation agency professionals indicated that universities are not sensitive to the needs of the profession. Examples of these professional needs are forestry, range, and wildlife management techniques, public policy and speaking, and research techniques (Peek 1989). University educators are challenged to meet core program requirements, by a wide range of student abilities, by research responsibilities, and by student idealism of what students perceive that they should and should not do. A wildlife management program is a diverse curriculum that includes biology, ecology, planning, statistics, research techniques, sociology, and future opportunity is enhanced by providing individual program flexibility (Peek 1989).

In the 1950's, academic ecology and wildlife management diverged and became separate entities (Wagner 1989). Academic ecology became conservation ecology (quantitative management of ecosystems for intrinsic values) and wildlife management remained oriented towards consumptive use. As a result, conservation ecology became scientifically based to explore natural phenomenon (Wagner 1989), and wildlife management muddled through to resolve wildlife management issues (Bailey 1982). Wagner (1989) strongly suggested that the wildlife profession commit to the diversity of societal wildlife values (e.g. consumptive and non-consumptive values) and strengthen the teaching, research, and application of wildlife science to meet these societal needs. The wildlife profession has become more central to a broad range of societal needs (e.g. consumptive use, non-consumptive use, endangered species, land-use, regulatory permitting, and animal damage control) (Nielson and McMullin 1992).

Romesburg (1991) presented the argument that wildlife management is based on observations of constructs (theory) instead of isolates (variables), whereas students should learn to isolate variables to understand the construct. He indicated a need to recruit students with abstract qualities as the researchers of microbiology and cosmology have done, which increased the level of scientific success and progress in those two fields. The resulting effect has been the expansion of knowledge from deductive logic based on accepted thought to reliable knowledge based on theory development, hypothesis formulation, and scientific testing (Romesburg 1981, Matter and Mannan, 1989, Romesburg 1989).

Gigliotti and Decker (1992) suggested that human dimension education should be integrated into wildlife management programs. A human behavior course developed particularly for wildlife management would provide practical application examples. Wildlife managers have had trouble in applying knowledge from basic social science courses to job experiences (Gigliotti and Decker 1992). Universities need to adapt ecosystem management programs to include courses in environmental ethics, ecological restoration, landscape ecology, human dimensions, conservation biology, and most importantly, how to "read" the land (Knight 1996).

> "The objective (of wildlife education) is to teach the student to see the land, to understand what he sees, and enjoy what he understands… perhaps the most important of these purposes is to teach the student how to put sciences together in order to use them. All the sciences and arts are taught as if they were separate. They are separate only in the classroom" (Aldo Leopold in Fladder and Callicott 1991:302).

Ecosystem stewards are expected to manage land for diverse purposes, which require a diversity of knowledge, understanding, and application (Knight 1996). Wildlife management is an action-oriented composition of disciplines that uses scientific judgment to evaluate phenomenon (Craighead 1998). Furthermore, the wildlife profession represents the ultimate in employment diversity; however, in spite of this diversity, wildlifers' hold a "common love and deep concern for all living things" that requires "vision, courage, integrity, a consuming passion, and a great diversity of talent" (Craighead 1998: 908, 910).

From the 1940's through the 1960's, plant science was an important component of most wildlife curricula (Arner, Johnson, and Speake 1998). Wildlife management requires the use of plant knowledge to develop and understand natural phenomenon (i.e. food habitat analysis, ecosystem relationships, and sustained development). Testing at Mississippi State University indicated that class averages for understanding botanical principles and plant identification were 30% and 25%, respectively (Arner et al. 1998). Arner et al. (1998) suggested that students should be required to complete at least nine hours of plant science (i.e. plant biology, plant taxonomy, plant physiology, plant ecology, and aquatic plants).

Leopold's essays had a broad educational lesson that focused on countering society's destructive use of natural resources (Kessler and Booth 1998). The educator's role is holistic, global environmental education that incorporates experiential learning, humanistic values, scientific principles, and ethical applications (Kessler and Booth 1998). Educators should educe students to engage in deep, ethical reflection on the relationships between man and the environment (Kessler 1995). The undergraduate Natural Resource program at the University of Northern British Columbia (UNBC) embeds Leopold's land ethics in every facet of learning (i.e. ecology, economics, and sociology). Finally, the capstone course requires each student to analyze, reflect, and defend their position on pertinent ecological issues without regurgitating the opinions of others (Kessler and Booth 1998).

> "If Leopold were here, he might attribute these difficulties to a mechanical, detached approach to education that inadequately encourages personal reflection and deep contemplation of the wider implications of human actions. We would have to agree with him" (Kessler and Booth 1998:712).

Natural resource managers need to think beyond their disciplines and incorporate other value systems (Jensen, Doescher, and Shelby 1998). Natural resource professionals (i.e. forestry, range, fisheries, wildlife, and outdoor recreation) are expected to collaborate to resolve issues and must be able to appreciate the views and values of others (Jensen et al. 1998, Thomas 2000). Furthermore, students' communication abilities must be technologically capable to successfully share information in a wide array of political, social, and ecological environments (Jensen et al. 1998).

The Future

> "Leopold's legacy is important and should be brought to the forefront on a regular basis to emphasize the historical, philosophical, ethical, and ecological roots of the wildlife profession," (Jones 1998:659).

Contemporary and future needs of wildlife management entail consumable and non-consumable wildlife, urban wildlife habitat management, threatened and endangered species protection, critical habitat management, landscape ecology, and stakeholder partnerships (Clark 2000). The manager's primary duty is natural resource stewardship through the application of science, practicality, human need, conflict resolution, cooperation, collaboration, and compromise (Thomas 2000). As a result, the wildlife professional has become an influential and valued member of private and public environmental management teams that protect endangered species and critical habitats (Thomas 2000).

Coreil (1995) indicated a collaborative process in the management and regulation of coastal Louisiana resources. Louisiana coastal landowners were surveyed to determine their perceptions of coastal issues. Indicated in the findings appears to be a collaboration of government and private entities working to preserve Louisiana's coastline (i.e. wetland planning, wetland economic production, wetland loss abatement, and coastal wetland ownership). Each of these issues involves a diverse grouping of stakeholders (i.e. attorneys, biologists, geographers, landowners, politicians, researchers) with a high degree of cooperation and collaboration (Thomas 2000).

As undeveloped land acreage decreases and wildlife competition increases for dwindling resources, contemporary extinction rates are greater than natural occurrence, which requires the wildlife professional to cooperate, compromise, and have political savvy (Krausman 2000). Students must be technically trained, globally diversified, sociologically aware, biologically sound, and have the desire, drive, and dedication to become successful professionals (Krausman 2000).

Wildlife stakeholders include consumers, non-consumers, American citizenry, educational institutions, college students, college-student parents, and environmental groups (Brown and Nielson 2000). Due to this diversity of stakeholders, Wildlife university administrators are accountable for program quality, stakeholder rapport, and the melding of stakeholder needs (Nielson and McMullin 1992, Brown and Nielson 2000). Because of this array of stakeholders, Brown and Nielson (2000) asked the question, "What directions should we take in our teaching, research, and extension programs, and for whom?" Their self-response indicated that students should follow a core program with specific upper-level courses, or degree programs tailored to fit student needs (Brown and Nielson 2000).

If the creation of scientifically adept graduates is the purpose of an undergraduate education, then restructuring the curricula with certain core competencies may be necessary to meet the needs of the graduate and profession (Romesburg 1991, Hard 1995). Matter and Steidl (2000) suggested that the responsibilities of wildlife education should be shared among employers, students and faculty. Extra-curricular experiences can be provided by employers through internships, cooperative education assignments, and sponsorship of undergraduate research, low-cost workshops for undergraduates, and interactions between chapters of The Wildlife Society (TWS) (Matter and Steidl 2000).

Students can personalize their learning by accepting responsibility for self-improvement, active participation, extra-curricular learning experiences, and selecting mentors (Matter and Steidl 2000). Faculty must dedicate their efforts to providing a rigorous and challenging environment, cooperate with other faculty to provide for an integrated program, and develop partnerships with employers to provide real world experiences (Matter and Steidl 2000). Due to the diverse sciences and concepts of the wildlife profession, individuals receiving additional training in natural history and evolutionary biology are more enlightened and better prepared for graduate school (Bleich and Oehler 2000).

Whitaker and Rosenberger (2000:1176) suggested three areas to develop a "fertile academic atmosphere…effective communication among students and faculty, developing professional skills in students, and effective approaches to scientific research." Communication opportunities are structured meetings (classroom lectures and office meetings), informal meetings (brownbag lunches and Friday pub meetings), and friendly conversations (how are you, where are you going). Professional and research skills could be gained by teaching mentoring and formal presentation (Whitaker and Rosenberger 2000).

Many wildlife professionals consider economic growth the greatest challenge to wildlife conservation (Czech 2000). Czech (2000:2) indicated a lack of economic understanding when coupled with wildlife conservation "is tantamount to an exercise in futility." As man nears carrying capacity, natural resources will decline and wildlife species will be lost at alarming rates due to the Principle of Competitive Exclusion (Czech 2000a). The wildlife curricula and profession should create a trans-discipline that integrates economics and ecology for a sustainable world, sustainable development, and biophysical economics (Hall, Jones, Donovan, and Gibbs 2000).

The wildlife graduate must have the skills necessary to discern unreliable and reliable information (Steidl, DeStefano, and Matter 2000). Steidl et al. (2000) presented the following concepts as central themes for graduate curricula:

1. to understand the principles of science and the ability to gather and synthesize reliable information from observed phenomenon
2. to develop clearly defined research questions or testable hypothesis
3. to distinguish between research hypotheses and statistical hypotheses
4. to understand that reliable data is the product of unbiased sampling and experimental design
5. to focus on creative thinking to develop experiments which investigate cause and effect relationships
6. to establish monitoring plans that collect data, which is normally lost to poor planning
7. to focus on ecological relationships, and to distinguish between statistical and biological significance.

Furthermore, coursework involving critical thinking (i.e. calculus, experimental design, population dynamics) assists students with solving complex, contemporary issues (White 2001). Wildlife management protocol must incorporate the use of rigorous methods to evaluate data. The purpose of higher order mathematics is to develop the ability to conceptualize a problem, develop an equation, and proceed to a solution for a real world phenomenon (White 2001).

Finally, "today's students are tomorrow's future" (Gould 2001:1022). As the wildlife profession enters the 21st century, field biologists have become wildlife-ecological scientists, which require considerable quantitative training (Gould 2001). Wildlife biologists are problem solvers, data collectors and interpreters, good scientists, and skilled workers (i.e. biology, communication, and computer). To facilitate these needs, programs, instructors, and pedagogies should transform to meet contemporary, quantitative demands (Gould 2001).

Wildlife Program Enhancement and Rigor

Leopold (1931) indicated that game management directly and indirectly involves several sciences and arts. No individual can acquire proficiency in all subject matter, and well-rounded daily work requires collaboration with other professionals (Leopold 1931). Leopold (1931) prepared the following list of academic courses that wildlife managers should complete.

Agricultural Engineering	Entomology	Meteorology
Agronomy	Forestry	Ornithology
Animal Husbandry	Geology	Physiology
Bacteriology	Herpetology	Watersheds
Biometry and Statistics	Horticulture	Zoology
Botany	Land Economics	
Ecology	Mammalogy	

Wildlife management is 90% people management, an area in which biologists are "woefully short" in understanding (Thomas 2000, Thomas and Pletscher 2000:548)

> "In the 1950's, our professors told us repeatedly "that wildlife management is 10% biology and 90% people management…then why was the program 90% science and 10% people skills? That has changed little over the decades" (Thomas 2000:1).

Because of the professional demands placed on wildlife biologists, the members of The Wildlife Society implemented a program to designate individuals as certified wildlife biologists (The Wildlife Society 1978, Yoakum and Zagata 1982, The Wildlife Society 2004). Currently, wildlife biology certification requires the completion of the following courses: 36 hours of biological science (wildlife management, biology, ecology, zoology, and botany), nine hours of physical sciences (chemistry, physics, soils, geology), nine hours of quantitative sciences (statistics, calculus, biometry), nine hours of humanities and social sciences (economics, sociology, psychology, political science), 12 hours of communication (English composition, technical writing, journalism, public speaking, mass media), and six hours in policy administration, and law.

Adelman, Schmidly, and Cohen (1994) attempted to survey all state fisheries and wildlife biologists in Texas and Minnesota to determine important knowledge concepts for fisheries and wildlife employees. The survey included items based on 65 courses or academic subjects and demographic questions concerning the employment, education, and personal background of the respondents. Of the 750 (500 to Minnesota and 250 to Texas) questionnaires generally distributed to both state agencies, there were 488 respondents, which indicated an overall response rate of 65% (301 from Minnesota and 164 from Texas). As a result, Adelman et al. (1994) identified 21 general knowledge concepts:

1. principles and procedures of wildlife management
2. environmental/habitat requirements, food resources, reproduction, mortality, life history, movement, and distribution of mammals or birds
3. population dynamics and assessment of the effect of hunting on wildlife populations
4. methods of age and sex determination for birds or mammals
5. taxonomy/identification of fish, birds or mammals
6. non-game and endangered species management
7. design, implementation, and evaluation of fisheries or wildlife management or research programs
8. laws and regulations pertaining to fishing or hunting
9. fish or wildlife habitat management and restoration techniques
10. general concepts of natural resources management

11. general ecology, animal ecology
12. plant ecology or forest ecology
13. social/ethical/economic aspects of natural resources management
14. identification of terrestrial or aquatic plants
15. map reading, aerial photography techniques
16. computer use for word processing and data analysis
17. fundamentals of budget preparation and management
18. employee supervision and management (people management)
19. public speaking
20. technical writing for scientific reports and publications
21. public relations theory and practice.

Oregon State University developed an integrated undergraduate program in Natural Resources that combines four colleges, Agricultural Sciences, Forestry, Liberal Arts, and Science (Jensen et al. 1998). The fundamental purpose is cross-training future land managers. The program is partitioned in essentially four units: university-wide core program, natural resources core (i.e. mathematics, statistics, biology, ecology), a breadth core (upper division credit from seven natural resource areas), and a specialized option core that focuses on the individual's future employment and graduate school needs.

Brown and Nielson (2000) discussed the outcome of a retreat held by the Texas A & M Wildlife and Fisheries Science Department. Attendees of the retreat were various State and Federal natural resource agencies (i.e. Texas Parks and Wildlife, US Fish and Wildlife Service). The attendees suggested that new graduates should have college-learned skills such as modern technology (e.g. computer generated media), writing, speaking, personnel management, budgeting, conflict resolution, and "by the way, be able to back-up a boat trailer and run a chainsaw." Brown and Nielson (2000) concluded by stating, "there is too much to learn in four years, so our concentration should be learning how to learn. That is, we must carefully choose foundation topics to present to our students, which prepare them for a life of continuing education."

Organ and Fritzell (2000) surveyed 14 major, university fisheries and wildlife programs in the United State. In the last two decades, program changes have incorporated non-consumptive wildlife values (conservation biology and human dimensions) and changes in pedagogy (experiential learning, critical thinking, and writing) (Organ and Fritzell 2000).   Other changes in programs include public perceptions, rare-species conservation, conflict management, multidisciplinary management, GIS, and landscape management.

Burger and Leopold (2001) agreed that undergraduate, wildlife management education must be based on hands-on, field oriented training (Ledford 1996). However, undergraduates from most programs lack the quantitative, analytical, and scientific skills to interpret ecological processes or to implement adaptive resource management (Burger and Leopold 2001). Burger and Leopold (2001) surveyed 62 natural resource programs identified in the Wildlife Federation's Conservation Directory to determine which programs included computer science, calculus, statistics, and biometrics to meet The Wildlife Society's (TWS) minimum requirement for biologist certification.   All universities required one computer course.   Ninety-three percent of the surveyed programs met the TWS total quantitative requirement (nine hours of combined statistics, calculus, computer science). However, only 54.8% of the programs complied by meeting the minimum criteria for certification. Additionally, Burger and Leopold (2001) suggested 40 statistical concepts undergraduate natural resource majors should learn.

For wildlife biologists to be quantitatively competent and comfortable, quantitative learning is implemented early in the Michigan State University undergraduate program

(Winterstein, Campa, Millenbah, and Coon 2001). The fisheries and wildlife program exposes students to increasingly complex problems via three levels of learning: 1) problem solving, 2) tools for quantitative problem solving, and 3) real world applications. Upon graduation, students meet the requirements for entry-level positions. To meet TWS biologist certification requirements, students must use elective credits in biology, botany, communications, and policy, administration, and law. The faculty considered the program to be ecosystem-based, problem-solving oriented and pre-professional (Winterstein et al. 2001).

Statistically-minded biologists are more apt to detect unforeseen problems in study design, which is equally important to the wildlife manager when judging the relevance of research findings (Johnson, Shaffer, and Newton 2001). To make these decisions, quantitative training is required. Johnson et al. (2001) recommended taking as many statistics courses as one could. By the end of a Master's program, the following coursework should be completed (Johnson et al. 2001):

1. Introductory probability and statistics
2. Probability and mathematical statistics
3. Theory of linear models
4. Sampling methodology
5. Experimental design

However, biologists who are not so quantitatively inclined should appreciate appropriate scientific designs, have access to expert assistance, be capable of defining clear objectives, and collecting good data (Johnson et al. 2001).

In closing, teaching students quantitative knowledge skills is met with two challenges: 1) an aversion to mathematics and problem solving, and 2) a lack of appreciation of statistical knowledge (Kendall and Gould 2002). As a result, undergraduate students have a "fear, aversion, or misunderstanding of statistics and its relationship to the scientific method" (Kendall and Gould 2002:623). Therefore, the need for statistical rigor is not recognized until after the data is collected.

Wildlife management students are trained to memorize facts, but are not trained to think scientifically (Kendall and Gould 2002). As a result, the student fails to bridge the relationships between problem solving, scientific methodology, and quantitative inference (Kendall and Gould 2002). Kendall and Gould (2002) suggested that a two-hour, freshman level course that focuses on scientific philosophy and adaptive resource management should be integrated into the program to introduce the importance of systematic, quantitative problem solving.

Twenty-First Century Competencies

Day and Koorland (1997) identified 12 competencies at three frequency levels that secondary students require for entry-level employment or college admission. High frequency competencies are critical thinking, the scientific method, and collaborative problem solving. Moderate frequency competencies are decision-making, effective multimedia communication, self-management, adaptability, information processing, and life-long learning. Low frequency skills are the logical use of higher-level mathematics, the organization and preparation of contextual information, and reading for application.

Lee and Blaszczynski (1999) surveyed Fortune 500 executives to determine the expected entry-level competencies of accounting graduates in the years 1992, 1997, and projected for 2002. Five competencies were identified in the following order of importance: accounting knowledge (analogous to wildlife management knowledge), communication skills, PC and Internet skills, group work/interpersonal skills, and problem solving skills. Over time, the importance of accounting knowledge competency decreased while the importance of communication, technology, collaboration, and problem solving increased (Lee and Blaszczynski 1999).

A proficiency approach focuses on what graduating economic majors can do with acquired knowledge and skills (Hansen 2001). Hansen (2001) developed a list of proficiencies to develop undergraduate critical thinking skills in economics. Hansen's proficiency list resulted from discussions with employers, students, colleagues, traditional liberal arts educators, and professional-vocational educators. The list consists of six proficiencies: access existing knowledge; display command of existing knowledge; interpret existing knowledge; interpret and manipulate economic data; apply existing knowledge; and create new knowledge (Hansen 2001).

Competency is commonly considered the effective application of knowledge and skills within a specific context for problem solving or construction (Westera 2001). Competencies are the new paradigm standard for program design, training, and professional development. Competency includes meta-cognitive thinking, which is the individual's ability to reflect upon personal knowledge, skills, and functional application. Theoretically, competence is cognitively structuring and facilitating specific behavior patterns to meet specific challenges (Westera 2001). Operationally, competency represents the ability to adapt to unpredictable situations using knowledge, skills, attitudes, meta-cognition, strategic thinking, and conscious decision-making (Westera 2001). However, the measurement of competencies is highly individual, difficult to standardize, and is a higher-level, cognitive skill (Westera 2001). The true determinants of human ability are possessing knowledge, attitude, and skill level (Westera 2001).

In business and industry, learning is aligned with performance-based assessment of competent task completion (Paulson 2001). Higher education is responding to industry needs by implementing performance-based, competency learning models (Paulson 2001). The focus is on the application of learned knowledge and skills for daily work needs. Paulson (2001:50) theorized four skill categories: “attitudes and personal characteristics; essential skills; integrative-applied skills: and premium skills.” Attitude and personal skills are adaptability, common sense, creativity, empathy, attitude, work ethic, reliability, and integrity. Essential skills are basic technical ability, collaborative teamwork, quantitative, reading comprehension, and verbal and written communication. Integrative-applied skills are technological application, critical thought, customer service skills, knowledge research ability, presentation communications, and problem solving. Premium skills are the ability to understand organizational and contextual issues, budgetary management, foreign language communication, globalism, multicultural understanding, negotiation, project management, and systems thinking.

Patterson, Crooks, and Lunyo-Child (2002) theorized the use of self-directed competencies to become life-long learners in the nursing profession. Students must develop self-learning competencies to guide, learn, and maintain individual professional standards (Patterson et al. 2002). The competencies required for self-directed learning are assessing learning gaps, evaluation of self and others, reflection, information management, critical thinking, and critical appraisal. Assessing learning gaps is the understanding of self and group knowledge gaps, the development of a skills toolbox, the ability to tolerate expectation ambiguity, and the diversity of learning styles. Self and group evaluation is the development of personalized assessment skills for self-evaluation. Reflection is the personal process of deep introspection that influences personal development. Information management is developing one’s system of searching, selecting, and critically reviewing information to problem solve. Critical thinking is the use of multiple resources, paradigms, and experiences to analyze contemporary and future issues. Critical appraisal results in the scholarly ability to utilize appropriate research knowledge to solve contemporary and futuristic issues.

Competency based instruction (CBI) is criterion-based and the focus is on student achievement (Lynch and Murranka 2002). Three barriers were indicated by faculty members: 1) lack of sufficient incentive to implement CBI; 2) lack of time to complete the task; and 3) satisfaction with the traditional approach. Students indicated that being responsible for completing assigned tasks and understanding how to study was their greatest barrier. However, a competency-based structure allows students more freedom to learn through testing and re-testing to learn and apply the material. The resulting grades are higher, which reflects a higher level of learning (Lynch and Murranka 2002).

Traditional business management education could better prepare undergraduate students for entry into the workplace (Dodd, Brown, and Benham 2002). Industry employers are seeking employees that are analytical, leaders, communicators, motivated, and self-starters (Porter and McKibbin 1988). To meet this need, Montana State University implemented a three-course sequence that emphasized practical skills and knowledge needed for soft-skill application and learning (Dodd et al. 2002). Three integrated techniques were used to "learn like you work" (Dodd et al. 2002:191):

1. Kolb's Learning Style Inventory (concrete knowledge, reflection, abstract thought, and hypothesis formulation) (Kolb 1984)
2. weekly journal assignments, and
3. personal, portfolio management.

Anecdotal student and faculty feedback indicated a positive perception of the learning strategy that allowed students to develop competencies in the soft skills needed by employers.

The Delphi Technique

When disagreement results from deficient scientific evidence and there is a need to assess agreement (consensus) and resolve disagreement (consensus development), two qualitative research methods may be used: the Delphi and the Nominal Group Technique (NGT) (Delbecq et al. 1975, Jones and Hunter 2002). The Delphi is most appropriate when expert opinions are geographically dispersed (Jones and Hunter 2002, Linstone and Turoff 2002). When stakeholder opinion is readily available, the NGT is the preferred method (Jones and Hunter 2002). The Delphi uses three to four rounds to elicit consensus. The NGT uses two rounds of highly structured meetings to develop consensus. Panelist or group participants are justifiable experts by some defining criteria (Jones and Hunter 2002).

The Delphi method "is based on the adage that two heads are better than one" (Dalkey 1969:6). The validity of the Delphi is based upon a purposeful sample of anonymous expert opinions through controlled feedback to form a specific group judgement of a phenomenon (Dalkey 1969). Delphi forecasting elicits expert consensus for contemporary and futuristic problem solving, decision-making, policy formulation, technological forecasting, and corporate planning (Dalkey 1969, Weaver 1971, Fontana and Frey 1994, Dunham 1998, Linstone and Turoff 2002).

Strauss and Zeigler (1975) described three Delphi Panels: 1) Numeric Delphi; 2) Policy Delphi; and 3) Historic Delphi. The Numeric Delphi is most commonly used to solicit quantitative consensus concerning an item, problem, or value. Policy Delphi produces qualitative (verbal) data, which establishes pro and con arguments on a particular subject. The Historic Delphi produces opinions that solve contemporary and anticipated problems from the philosophical opinions of historical figures.

Linstone and Turoff (2002:3) suggested ten contemporary uses:

1. To gather current and historical data not accurately known or available
2. To examine the significance of historical events
3. To evaluate possible budget allocations

4. To explore urban and regional planning options
5. To plan university campus and program development
6. To put together the structure of a model
7. To delineate the pros and cons associated with potential policy options
8. To develop causal relationships in complex economic or social phenomena
9. To distinguish and clarify real and perceived human motivations
10. To expose and prioritize personal values and social goals.

Delphi Methodology

The historical form of the Delphi was the paper and pencil "Delphi Exercise." The contemporary form of the Delphi is the "Delphi Conference" (Linstone and Turoff 2002:5). The Delphi Conference utilizes computer technology to provide "real time" output.

The Delphi generally consists of three phases (Dalkey 1969, Delbecq et al. 1975, Wilhelm 2001, Linstone and Turoff 2002).

1. Phase 1 consists of a generalized instrument to generate ideas from each individual panelist expert. Once each panel member responds, the facilitator consolidates the opinions into common concepts in preparation for the second iteration.
2. Phase 2 is the second iteration of the Delphi to each panel member. Each panelist completes the second instrument by rating each instrument, and provides items not currently listed. The facilitator collects the second instrument and reduces the items into common denominators for the final instrument.
3. Phase 3 is the final iteration of the Delphi. The facilitator administers the instrument, and provides for each panelist his or her score and the group mean score $\pm$ the standard deviation for each item.

The Delphi usually has one or more of the following embedded properties (Linstone and Turoff 2002):

1. The problem lends to subjective judgment and not to analytical techniques.
2. A diverse range of expert panelists need to examine a broad, complex problem and communication capability is limited to written communication.
3. More individuals are needed than can effectively interact in a face-to-face exchange.
4. Time and cost make frequent group meetings impractical.
5. A supplemental group communication process can increase face-to-face meeting efficiency.
6. Disagreements among individuals are so severe or politically unpalatable that the communication process must be refereed and/or anonymity assured.
7. The heterogeneity of the participants is preserved to assure valid results (i.e. avoidance of domination by quantity or by strength of personality – "bandwagon effect").

Delphi Validity

The Delphi is a method to gather wisdom and deliberative judgment; therefore, the Delphi collects and synthesizes pertinent, soft data (Coates 1975). Validity of the Delphi relates to the particular circumstances and needs of the phenomenon (Linstone and Turoff 2002). Validity is enhanced by anonymous, specific stakeholder response, systematic-controlled feedback, and statistical group consensus, which minimizes the bias of dominant individuals, controls irrelevant communications, and removes group pressure that biases individual perceptions (Dalkey 1969, Cyphert and Gant 1971, Linstone and Turoff 2002).

Internal validity is the accuracy of the intended outcome (Vogt 1999). The Delphi is compromised by poor design, poor panelist selection, honesty of the facilitator(s) and language barriers (i.e. differences in language, differences in concept meaning, and differences in cultural background) (Linstone and Turoff 2002).

On the surface, the Delphi is simplistic (Linstone and Turoff 2002). However, when the Delphi is applied without due planning, the results are disappointing (Linstone and Turoff 2002). Linstone and Turoff (2002:6) provided “some” reasons for failure to produce good results:

1. The monitor imposes his or her preconceptions upon the panel by over-structuring the Delphi, and does not allow for the contribution of other problem-related perspectives.
2. The Delphi is used as a communication cure-all for any situation.
3. Group responses are poorly summarized and presented.
4. Evaluation scales utilized in the exercise do not provide for common interpretations.
5. Disagreements are ignored and dissenting panelists drop out, which generates an artificial consensus.
6. Participating as a Delphi panelist is demanding. Panelists should be recognized as consultants, and should be compensated if the Delphi is not integral to their job function.

Linstone (2002) constructively discussed eight “basic pitfalls” of the Delphi technique when gathering expert or stakeholder opinion (qualitative data). The Delphi uses structured communication to gather meaningful information from experts or pertinent stakeholders (Linstone and Turoff 2002). The eight pitfalls are discounting the future, the prediction urge, the simplification urge, illusory expertise, careless execution, optimism-pessimism bias, overselling, and deception.

Western values are typically focused on immediate rewards, which may discount futuristic predictions (Linstone and Turoff 2002). The degree of discounting varies spatially, temporally, and individually. Discounting may be avoided by communicating a futuristic perception by using real world examples or a futuristic imagination (Linstone and Turoff 2002).

A major focus of the Delphi is to predict an outcome based on consensus; however, a consensus opinion can mask differences that should be recognized as alternatives (Turoff 2002). A Delphi panel can be used to identify and explore alternative approaches, which is a deviation from the historical use of the Delphi.

Furthermore, simplistic research design is preferred to complex design (Turoff 2002). However, if the facilitator identifies too few variables, the model is insufficient. A variable that should be recognized is individual subjectivity, which is similar to intercession history (Campbell and Stanley 1963). Individual subjectivity is a result of history, culture, conflict experiences, language barriers, and internal belief systems (Turoff 2002). Turoff (2002) cautioned the precariousness of comparing two individual's perceptions when personal opinions are subjected to life experiences.

Delphi forecasting relies on expert panel consensus; however, the group of experts may not comprise a full complement of opinions, which can lead to faulty consensus building (Turoff 2002). Therefore, while consensus has been reached, consensus does not assure good judgment or superior estimates (Turoff 2002). Panel selection must ensure equal opportunity for diverse opinion.

Careless execution is the result of poor experimental design and superficial response analysis by the researcher, as well as respondent impatience to complete the task (Turoff 2002). Proper planning should take into account orderly procedures to collect data, synthesize data, and conserve the panelists' time and attention.

Optimism and pessimism bias commonly occur in short-term and long-term forecasting, respectively (Turoff 2002). Short-term optimism ignores incomplete system development. Long-term pessimism relies on experience and reduces creative imagination.

The Delphi is not a cure-all focus methodology (Turoff 2002). The Delphi facilitator must understand the needs of the user or organization. Repeated Delphi use on the same panelist may result in idea regurgitations. Pressure to produce a consensus may cause the facilitator to satisfy the client first. Anonymity may threaten organizational relationships when consensus is less important than identity.

Deception is the intentional use of false information for manipulative purposes (Turoff 2002). Poor, incomplete, or misleading information in the first round leads to distorted second and third round results. Delphi research design constructed on sound philosophy, theory, and validity results in the practice of a potent communication process.

Application of the Delphi

Numerous studies have utilized the Delphi technique to procure expert or stakeholder perceptions concerning various, futuristic aspects of a particular profession or problematic area (Buriak and Shinn 1989, Gaspard 1992, Birch, O'Toole, and Kanu 1997, Farmer 1998, Mitchell 1998, Wilhelm 1999, Rockwell, Furgason, and Marx 2000, Larson and Wissman 2000).

National agricultural academic leaders (deans of resident instruction in colleges of agriculture, directors of experiment stations, and deans of education) participated in a Delphi panel to develop a consensus and to provide focus and direction for research efforts in agricultural education (Buriak and Shinn 1989). Fifty-four academic Deans reached consensus on 11 mission statements to establish programmatic research efforts in agricultural education (Buriak and Shinn 1989).

Sanders (1992) utilized a modified Delphi study to identify the research priorities of the Louisiana Cooperative Extension Service with regards to meeting Louisiana's future agricultural needs. Forty Louisiana Cooperative Extension faculty identified 165 potential research items. To guide the Delphi panelist, Sanders (1992) utilized seven general categories. The seven categories were staffing patterns, program development, program implementation, program emphasis, program evaluation, barriers to technological adoption, and other research needs.

Innovative plant science leaders (university plant scientists, industry plant scientists, and secondary agricultural teachers) developed a consensus of plant science concepts to learn in secondary agriculture programs (Gaspard 1992). Thirty-one plant science leaders identified 191 concepts that should be learned in a futuristic, secondary, plant science program (Gaspard 1992).

Public university students (n per Delphi round = 268, 269, and 274, respectively) enrolled in personal health classes from Idaho, Indiana, North Carolina, Pennsylvania, and Virginia participated in a Delphi to determine if health issue discussions between students and parents were important to promoting student and parent health (Birch et al. 1997). A majority of the students (56 %) participating in the Delphi indicated that parent-offspring discussions could be important in promoting parent and offspring health (Birch et al. 1997).

The education and training of competent, insightful nurse practioners must reflect the needs of health care consumers (Mitchell 1998). Thirty-three administrators of nursing programs concluded that 22 of 26 events previously predicted had occurred, and that 24 of 25 events that had not occurred remained viable (Stead 1975, Mitchell 1998). The administrators indicated concerns for improving nursing education via entry level educational requirements, program planning, program expansion, credentialed faculty, academic uniformity, and professional unity among state educational programs (Mitchell 1998). The expert panel indicated a continued commitment to nursing education (Mitchell 1998), which indicates the face validity concerning the needs of these particular stakeholders (Ary, Jacobs, and Razavieh 1996, Patton 1996).

In 1994, research needs of Tech Prep education were predicted using the Delphi technique (Farmer 1998). The intent of the research was to guide and forecast research needs of young scholars and vocational researchers in Tech Prep. Fifty-six nationally recognized teacher educators and administrators of four-year colleges and universities were selected to serve on the panel. Thirty-seven selectees agreed to serve on the panel; however, 33, 30, and 27 responded to rounds 1, 2, and 3, respectively. The Delphi panel selected 11 major research categories. In ranked order (highest to lowest), the top three research priorities were program development, staff development, and instructional strategies (Farmer 1998).

Specific skills and competencies for entry-level employees were identified in a three-round, modified Delphi by a panel of 24 hiring managers, human resource specialists, small business owners, and cooperative occupational education specialists (Wilhelm 1999). The initial instrument used 37 competencies from the "What Work Requires of Schools: A SCANS Report for America 2000" to develop the initial questionnaire for phase 1 (Wilhelm 1999). Results indicated that the upper one-third of the skill items were human interactive abilities, the middle third were individual self management, and the lower third were technical skills and resource allocations skills, which were not considered entry-level skills.

Rockwell, Furgason, and Marx (2000) used a modified Delphi technique to evaluate the research and evaluation needs of distance education. A steering committee was utilized to identify potential Delphi panel members and relevant distance education research needs. The steering committee identified 39 items (along with sub-topics) and the Delphi panelists that ranged from 20 – 28 per iteration. After three Delphi rounds, four main themes emerged: 1) to create a collaborative and cooperative environment among state institutions; 2) to identify strategies that provide effective distance learning experiences; 3) to identify effective competencies and support mechanisms; and 4) to determine participation, completion rates, and assess outcomes.

A modified Delphi panel was used to determine the critical academic skills that Kansas community college associate degree graduates should have (Larson and Wissman 2000). A steering committee of community college deans nominated panelists by the following criteria: 1) greater than three years teaching experience at the community college level; 2) a demonstrated commitment to professional development through innovative teaching practices; 3) instrumental in assessment of institutional effectiveness; and 4) opinions are respected by peers and administrators. The panel resulted in 30 members with 15 deans and 15 faculty members. After three iterations, five critical academic skills were identified: 1) written and oral communication of thoughts, complex ideas, and questions; 2) an awareness of how cultural and social differences influence various assumptions; 3) critical thinking and judgment through reliable information gathering techniques; 4) basic arithmetic skills; and 5) effective cooperative teamwork (Larson and Wissman 2000).

Sample Size for the Delphi Panel

Buriak and Shinn (1989) utilized 54 Deans to reach consensus on 11 mission statements to establish agricultural education research. Gaspard (1992) used 31 plant science leaders to determine 191 plant science concepts for a secondary plant science program. A large sample size per iteration (268, 269, and 274) was used to determine the value of parent-student discussions to promote student health (Birch et al. 1997). Thirty-three administrators (panel members) were used to improve nursing education (Mitchell 1998). Farmer (1998) used the Delphi to predict Tech Prep research needs and panel size varied by iteration (33, 30, and 27, respectively). Twenty-four Delphi panelists determined the specific skills and competencies for entry-level employees (Wilhelm 1999). Rockwell et al. (2000) utilized a 43-member Delphi panel to determine the research and evaluation needs for distance education. Larson and Wissman (2000) used a modified Delphi panel (n = 30) to identify critical academic skills.

Research Focus

The most important product of an undergraduate program is the primary stakeholder, who has earned a Bachelor's degree. Embedded within the wildlife management undergraduate program should be marketable, entry-level job skills. There are a number of entry-level job skills (i.e. plant identification, plant surveying, aging techniques, management planning, research design, public relations, etc.). However, what contemporary and futuristic entry-level job skills should be learned that optimize post-undergraduate employment opportunity?

There are three basic employment sectors for wildlife management undergraduates: academia, public, and private. Within these three groups exists a diversity of employment opportunities. However, is there a generic list of entry-level job skills that meets the needs of most employers? In addition, how can this information be reliably collected and consolidated to develop a futuristic undergraduate wildlife management program?

When expert knowledge is dispersed geographically, the Delphi Panel is an accepted method of gathering and forming expert consensus and descensus on contemporary and futuristic issues. Information is systematically gathered from confidential experts to predict futuristic needs. However, the Delphi is qualitative research, which provides direction for further empirical investigation.

Therefore, a Delphi Panel of purposefully selected Wildlife Management Experts will provide reliable and valid guidance to develop a list of job skills needed by entry-level wildlife management professionals.

CHAPTER 3

METHODOLOGY

The purpose of this research was accomplished by using a modified Delphi technique to identify the job skills needed by entry-level wildlife managers. The Delphi technique is qualitative research that utilizes a purposeful sample of dispersed, anonymous experts to develop consensus for contemporary and futuristic guidance (Dalkey 1969, Weaver 1971, Coates 1975, Delbecq et al. 1975, Gaspard 1992, Fontana and Frey 1994, Dunham 1998, Wilhelm 2001, Linstone and Turoff 2002).

The transmission of this Delphi was solely via internet transmission. The Delphi facilitator (Billy DeLany) and Webmaster technician (Safia Dawood) collaborated to complete this research initiative. The facilitator developed the instruments for Round One, Round Two, and Round Three. The webmaster technician utilized MICROSOFT ® Active Server Pages (ASP.NET) and MICROSOFT ® ACCESS to write the scripting for online instrument access and report formats.

Population and Sample

The target population for this research was defined as wildlife managers currently employed in professional positions that are innovative in their practices and forward thinking regarding their approach to wildlife management. These wildlife managers were referred to as "experts" in the wildlife management profession. The sampling plan for the study included the following steps:

1. An initial steering committee of three members was identified by the researcher. Selection was based on each member's recognized expertise in each of the following work sectors: academia, private, and public.

2. Each initial steering committee member nominated at least five individuals as potential expanded steering committee members. Nomination was based on their recognized expertise in wildlife management.
3. Each expanded steering nominee who volunteered to serve as an expanded steering committee member nominated at least five potential Delphi panel members.
4. All nominees, which included the initial steering committee, expanded steering committee, and panel nominees comprised the pool of potential Delphi panel members, which was defined as the frame of the target population.
5. The Delphi panel members were drawn from the established population frame on a purposeful basis. The selection criteria was: (a) number of nominations received, (b) employment venue with emphasis placed on ensuring representation from each sector (Academia, Public, and Private), and (c) willingness of the potential panel member to participate in the three rounds of the Delphi study.

Sample size (panel size) varies according to the needs of the particular Delphi study. Panel sizes of previous Delphi studies ranged from 24 to 274, with most sample sizes approximating 30 (Buriak and Shinn 1989, Gaspard 1992, Birch et al. 1997, Mitchell 1998, Farmer 1998, Wilhelm 1999, Rockwell et al. 2000, Larson and Wissman 2000). Dalkey (1972) and Delbecq et al. (1975) indicated that a panel size of 30 provides satisfactory reliability although small, homogeneous sample sizes (n = 10 – 15) are common in Delphi panel research (Linstone and Turoff 1975, Wilhelm 2001). For this study, 39 panelists were purposefully selected from the pool of 81 panel nominees.

Development of the Delphi Panel Pool.--Each initial steering committee member was contacted by telephone and invited to participate in the study. Upon agreement to participate, each initial steering committee member was requested to nominate at least five expanded committee members to compose the expanded steering committee. To assist each initial steering committee member, a follow-up email of instructions was transmitted (Appendix A). Provided in the email was a thank you, an iteration of responsibilities, the focus question, the definition of an entry-level job skill, and nomination criteria.

Once the expanded committee nominees were received from the initial steering committee, each expanded committee nominee received the initial email requesting their assistance to nominate potential panelists (Appendix B) and email letter of instruction (Appendix C) to nominate Delphi panelists for this study. Expanded committee nominees that did not respond to the first email request were sent the second and third email requests to nominate potential panelists (Appendices D and E) with the attached letter of instruction (Appendix C).

Delphi Panel Pool of Nominees.--Three initial committee members nominated 23 potential expanded committee members. Of the 23 expanded committee nominees, 12 became expanded committee members and provided 92 nominations. Multiple nominations did occur, and nominations crossed-over workplace sector lines. However, nominees were placed in their respective workplace sector for panel selection.

The Delphi pool of nominees included the three initial steering committee members, 12 expanded committee members, and 66 nominees, which provided a pool of 81 panel nominees.

Time Frame to Develop the Delphi Pool of Panel Nominees.--The time frame for gathering the panel nominees was approximately 30 days. The email requests were transmitted on November 2, 2003, November 16, 2003, and November 23, 2003. Six expanded committee members responded with their nominees by November 16th. Eight expanded committee members responded with their nominees by December 1, 2003. No additional responses were received by December 10, 2003.

Delphi Panel Selection from the Delphi Panel Pool.--The Delphi panel members were drawn from the established panel pool (N = 81) by the following criteria: (1) number of nominations received within each perspective workplace sector, (2) employment venue with emphasis placed on fair representation from each employment sector, and (3) the willingness to serve on the panel for three consecutive survey rounds.

Panel nominees were telephoned until a sample of at least ten panelists volunteered from each workplace sector. In each telephone conversation, the nominee was introduced to the researcher and the purpose of the Delphi study, which followed the guidelines of a written script (Appendix F).

After a three-day period of rigorous and repetitive telephoning, 40 panelists were contacted and 39 volunteered to serve as panel members. One nominee who was contacted could not participate due to his work schedule. Because of the panel selection process, 13 panelists were drawn from academia, 13 panelists were drawn from the private sector, and 13 panelists were drawn from the public sector (N = 39). Of the 13 academic sector panelists, six were professors, four were department heads, and three were state level Cooperative Extension personnel. All 13 of the private panelists filled positions that were supervisory/managerial. The public sector panelists were composed of 10 federal wildlife managers and three state wildlife managers.

All panelists were from the United States. Twenty-three panelists were from the Southeastern United States. Seven were from the North Central, and three were from each of the following areas: Northeast, Northwest, and Southwest.

Instrumentation

Round One Instrument.--This Delphi research consisted of three unique survey rounds. Round One utilized the study focus question and curriculum concentrations to guide, gather, and consolidate Delphi Panel's expert opinion to develop the initial list of entry-level job skills (Dalkey 1969, Delbecq et al. 1975, Linstone and Turoff 2002). The focus question and instructions for Round One are provided for the panelists in the Round One letter of instruction (Appendix G) and Round One Instrument (Appendix H). The focus question for this study was:

"What are the job skills needed by entry-level wildlife managers?"

To provide further guidance for the panelists (Sanders 1992), the Round One instrument included the curriculum concentrations for biologist certification by The Wildlife Society and the category "Practical Daily Work Skills." Panelists were requested to identify job skills associated with each curriculum concentration. The Wildlife Society curriculum concentrations were Biological Sciences (wildlife management, biology, ecology, zoology, and botany), Physical Sciences, Basic Statistics, Quantitative Sciences, Humanities and Social Sciences, Communications, and Policy, Administration, and Law. "Practical Daily Work Skills" was included to gather information on job skills that are fundamental to wildlife management field and office work (i.e. equipment operation, writing management plans, and communicating effectively).

Round Two Instrument.--The Round Two letter of instruction (Appendix I) provided guidance to complete the Round Two instrument (Appendix J). The Round Two instrument was the compiled results of the Round One instrument. Each panelist's list of entry-level job skills was reviewed, and similar job skills were consolidated for clarity and brevity (Gaspard 1992). However, items that appeared similar yet were unique were maintained as separate items. Due to the number of items (N = 382), the Round Two instrument was divided into eight sub-instruments, which followed the guidance headings from the Round One instrument. The panelist were requested to rate each entry-level job skill on the anchored scale provided below:

- 5 = high importance

- 4 = substantial importance
- 3 = moderate importance
- 2 = low importance
- 1 = no importance.

For ranking the results of each sub-instrument, the anchored scale was interpreted in the following manner.

- 5.00 – 4.50 = high importance
- 4.49 – 3.50 = substantial importance
- 3.49 – 2.50 = moderate importance
- 2.49 – 1.50 = low importance
- 1.49 – 1.00 = no importance.

Round Three Instrument.--Round Three completed the Delphi survey. A letter of instruction for Round Three (Appendix K) provided the guidance and hotlink (Appendix L) to complete the Round Three instrument. The Round Three instrument was unique to each panelist and was divided into eight sub-instruments (Appendix M). Information included in the Round Three instrument was the individual panelist's rating for each item, and the group median for each item.

Data Collection

Data was collected by email transmission. Each panelist received an email transmission that provided instructions and an instrument hotlink for each survey round. The panelist clicked-on the hotlink and gained access to the instrument home page for each round. Upon completion of each instrument, the panelist submitted his or her results by clicking on the submit button. The data for Round One was verbal qualitative data and was sorted by the researcher. The data for Round Two and Three was forwarded to an access database and was sorted by item. To debug the data collection system, a pilot transmission of each Round instrument was tested prior to transmission.

Round One Data Collection.--Round One data was collected in following manner. Due to the time of year (Christmas and New Year Holidays) and technical malfunctions (computer upgrade, computer failure, and a campus-wide electrical outage), the following sequence occurred during the collection of the Round One data. Each panelist received the Round One letter of instruction and instrument hotlink on December 18, 2003. Due to the holiday break, the panelists were given until January 9, 2004 to complete and forward the Round One instrument.

Due to the computer upgrade of the researcher's computer, on December 26, 2003, panelists who had not responded were emailed a reminder and hotlink (Appendix N).

On December 29, 2003, McNeese State University experienced a power outage, which did not allow submission of the Round One instruments on that date. As a result, an explanation email and instrument hotlink was forwarded to the panelists who tried to respond but were unsuccessful or who had not responded as of December 29th (Appendix O).

On January 6, 2004, the panelists that had not responded were sent a short reminder with a Round One instrument hotlink (Appendix P). On January 12, 2004, a final reminder and extension date was emailed to those panelists who had not responded (Appendix Q). The deadline for the non-respondent panelists was set for January 16, 2004. By January 16, 2004, 34 of the 39 panelists had responded; however, as indicated in the January 12th reminder, those panelists who could not reply to the Round One instrument were retained as panel members for Round Two. No other panelists responded after January 16, 2004.

Round Two Data Collection.--On January 23, 2004, the Round Two instrument was under construction. However, due to sequence of technical failures (hard drive crashed twice, zip drive crashed once, and one computer virus infection), the research was delayed. However, computer documentation to that date had been saved in triplicate and no data was lost. At that time, all panelists were notified of the delay (Appendix R).

On February 13, 2004, each panelist was emailed a copy of his or her Round One results, the Round Two letter of instruction (Appendix I), and the hotlink to the Round Two instrument (Appendix J). Each panelist was requested to complete the Round Two instrument(s) and transmit his or her results by email within five working days (February 20, 2004).

On February 21, 2004, panelists who had responded with incomplete data or were non-respondents were sent an extension date reminder and Round Two instrument hotlink to complete the Round Two instrument by Friday, February 27, 2004 (Appendix S).

By February 27, 2004, panelists who had responded with incomplete data or were non-respondents were sent a final request to respond to the Round Two instrument by March 8, 2004. However, to encourage the response rate, the final email transmission included each sub-instrument as an attachment (Appendix T). The attached sub-instruments allowed the panelists to complete and forward their data directly to the researcher who inputted the data. The final data for Round Three was collected by March 15, 2004.

Round Three Data Collection.--After the results of the Round Two instrument were compiled into the Round Three instrument, each panelist was emailed the Round Three instructions (Appendix K) and a hotlink to each panelist’s unique set of Round Three instruments (Appendix L), which allowed each panelist to enter his or her unique Round Three instruments and data (Appendix M).

The Round Three instruments were emailed to the panel on March 26, 2004. Each panelist was requested to complete the Round Three sub-instruments and forward his or her results by email within five working days. On the fourth working day (April 1, 2004), 19 of 32 panelist had responded. On April 1, 2004, a telephone call was made by the researcher to each non-respondent panelist for completion of the Round Three survey instruments by April 5, 2004. Due to the varied workloads and requests of the panelists for later response dates, the data was not analyzed until April 8, 2004. By April 8, 2004, only one panelist was a non-respondent. Thirty-one of 32 panelists responded to the Round Three survey instrument.

Data Analysis

Round One Data Analysis.--The Round One data was collected from each panelist, and similar job skills were compiled into one item. However, as a function of diverse panel workplace needs (employment sector, geographic location, and individual specialties), items that were similar, yet slightly different, were included as unique items. The objective was to err on the side of caution and not delete data (panelist opinion) based on the researcher's opinion of similarity among items. Because of this process, 382 items were used to construct the Round Two instrument.

For example, items 74, 75, and 76 focused on the ability to identify plant species. Item 74 focused on the basic knowledge of plant taxonomy, which is knowledge-based and broadly applicable. Item 75 focused on dendrology, which incorporates plant taxonomy knowledge but emphasizes tree identification. Item 76 focused on the ability to key-out regional and national plant species, which is a broad application. The common denominator among these items was the ability to identify plant species; however, knowledge, industry specific needs, and regional workplace needs indicated slightly different workplace needs.

Round Two Data Analysis.--Once the data was collected from Round Two, the group median, overall group mean and standard deviation for each entry-level job skill (item) were calculated. Items were ranked by descending mean scores from 5 to 0 (highest importance to no importance), which indicated the importance of the entry-level job skill by the panel. In the case of a tie between mean scores, items were then ranked by ascending standard deviation scores.

The standard deviation indicated the dispersion of panel opinion about each item. A smaller standard deviation indicated more agreement on the rated item, which indicates slightly more importance among items with tied means and allowed for a quantitative ranking of all items.

The summary data of Round Two was used to develop the Round Three instrument. Each panelist's unique score and the group median score by item were provided in each panelist's unique and confidential Round Three instrument.

Round Three Data Analysis.--Round Three data was collected and summarized. The median, mean, standard deviation, and consensus were calculated for each item. Items were ranked by descending mean scores from 5 to 0 (highest importance to no importance), which indicates the importance of the entry-level job skill item by the panel. Consensus and level of consensus were calculated by dividing the number of panelists who were within $\pm$ 1 of the median by the total number in the panel. Item consensus was reached when 51% of the respondents rated the item within one point of the median on the five-point, anchored scale of importance (Gaspard 1992).

The entry-level job skill items were ranked from the highest to the lowest group mean. In the case of a tie, the item with the least standard deviation was ranked first (Gaspard 1992). In case of tied means and standard deviations, the level of consensus was used to break the tie. In the case of a tie between mean scores, items were then ranked by ascending standard deviation scores. The standard deviation indicated the dispersion of panel opinion about each item mean. As the standard deviation decreased, panel agreement on the rated item increased, which indicated slightly more importance among items with tied means and allowed for a quantitative ranking of all items. In the case of tied means and standard deviations among items, level of consensus was used to break the tie. For example, items 87 and 88 had tied means of 4.39 and tied standard deviations of 0.72; however, the level of consensus was 97.6 and 87.1, respectively.

The level of consensus ranking indicated a slightly different importance value between these two items.

CHAPTER 4

RESULTS

The purpose of this study was to identify the job skills needed by entry-level wildlife managers. To accomplish this objective, a Delphi panel of innovative wildlife experts identified and rated the importance of entry-level job skills through three iterations of a Delphi survey.

Results of Round One Delphi Panel Survey

The Round One letter of instruction (Appendix G) and instrument (Appendix H) were emailed to all panel members (N = 39) on December 18, 2003. Four reminders (Appendices N, O, P, and Q) were forwarded on December 26, 2003, December 29, 2003, January 6, 2004, and January 12, 2004, respectively. No Round One responses were received after January 16, 2004, which was the first day of Round One data analysis. The time period to collect the Round One responses was 30 days inclusive of December 18 and January 16.

The Round One Delphi panel consisted of 39 members of which panel members were evenly distributed among the academic, private, and public workplace sectors. The responding Round One Delphi panel included 31 respondents of which 10 were academic, 10 were private, and 11 were public wildlife managers. Eight Round One panelists did not respond to the Round One instrument. However, since panelists who did not provide open-ended responses to the Round One survey could still provide useful ratings of the importance of items in the Round Two survey, all of the 39 Delphi panel members included in the Round One survey were asked to respond to the Round Two instrument. Throughout the study, respondents were always afforded the opportunity to add items that they felt were needed or should be included among the entry-level job skills of wildlife professionals.

The Round One instrument was divided into eight sub-instruments. The sub-instrument areas were biological sciences, physical sciences, basic statistics, quantitative sciences, humanities, communications, policy administration, and practical daily work skills. The Round One survey resulted in 1,082 item submissions. As responses were received from each panelist, each panelist's list of entry-level job skills was reviewed, and similar job skills were consolidated to avoid excess redundancy. However, when items appeared similar yet had potentially unique components, the items were maintained as separate items. The uniqueness of items was preserved as a precaution to maintain the integrity of any unique contribution from panelists who participated in the study. As a result, the 1,082 submitted items were reduced to 382 unique items.

Round One Biological Sciences Entry-Level Job Skills.--Listed in Table 1 are the unique entry-level job skills identified by the Delphi panel in the biological sciences area. A total of 107 items were identified by the panel members that were judged by the researcher to have some unique aspect or component. Since there was no meaningful priority for items submitted through the open-ended responses of the Round One instrument, the items are ordered as the Round One instruments were received from the panelists.

Table 1. Entry-Level Biological Job Skills Needed by Wildlife Management Professionals Identified by Wildlife Management Experts in a Round One Delphi Survey.

	Biological Sciences Entry-Level Job Skills
1	To have a sound foundation in biology.
2	To have a sound foundation of zoology.
3	To have basic knowledge of avian reproductive physiology.
4	To have basic knowledge of mammalian reproductive physiology.
5	The ability to identify signs and symptoms of common wildlife diseases.
6	To have an understanding of modern genetic approaches in wildlife conservation.
7	To have a working knowledge for ageing, sexing, trapping, capturing, handling, marking, and radio telemetry tracking of wildlife.
8	To have a basic knowledge of herpetology.
9	To have knowledge of wildlife damage management principles.
10	The ability to identify animal sign for animal damage control assessment.
11	The ability to identify mammals, birds, reptiles, amphibians, and fish to species; insects to order; other invertebrates to phyla and order through the use of a key.
12	To have a basic knowledge of entomology with emphasis in aquatic insects and tree

(Table cont.)

	damaging pathogens.
13	The ability to locate, read, and comprehend reliable life history knowledge of mammals, birds, reptiles, amphibians, fish, insects, and other invertebrates.
14	To have knowledge of the factors affecting plant growth, reproduction, fitness, and survival including knowledge of diseases and genetics.
15	To have knowledge of the factors affecting wildlife growth, reproduction, fitness, and survival including knowledge of diseases and genetics.
16	To have knowledge of the effects of disease on wildlife growth, reproduction, fitness, and survival.
17	To have knowledge of the effects of genetics on wildlife growth, reproduction, fitness, and survival.
18	To have knowledge of techniques for estimating plant density and diversity.
19	To have knowledge of techniques for estimating animal density and diversity.
20	To have basic knowledge of mammology.
21	The ability to key-out a mammal species.
22	To have basic knowledge of mammalian anatomy.
23	The ability to perform basic necropsy procedures and protocol, which include sample collection and tissue storage.
24	To have basic knowledge of mammalian physiology.
25	To have basic knowledge of ornithology.
26	The ability to key-out an avian species.
27	To have basic knowledge of avian anatomy.
28	To have basic knowledge of avian physiology.
29	The ability to identify, sex, and age waterfowl.
30	The ability to identify, sex, and age neotropical birds.
31	The ability to key-out vertebrate species.
32	The ability to key-out invertebrate species.
33	To have a strong foundation in wildlife management principles and techniques.
34	To have a sound understanding of ecological principles and concepts of the relationships between plants, animals, and the environment.
35	To understand the need for conserving and protecting biodiversity in management planning.
36	To have a sound foundation of plant ecological principles and processes.
37	To have an understanding of range ecology and management principles.
38	To have a sound foundation of wildlife ecological principles and processes.
39	To have a working understanding of population dynamic principles.
40	To have a basic understanding of ecology (population, community, and ecosystem).
41	To have the basic understanding of landscape ecology for ecosystem restoration and management planning.
42	To have the basic understanding of wild land fire ecology.
43	The ability to recognize variables and relationships within an ecosystem (plant-animal-environment).
44	The ability to utilize man-made practices as useful ecological management tools (grazing, prescribed fire, herbicide application, logging, agronomic practices, etc).
45	To understand wildlife harvest management concepts and implications when developing

(Table cont.)

	management plans.
46	To have knowledge of all basic wildlife courses.
47	The ability to identify and utilize specific state-of-the-art wildlife management methods and techniques for high profile non-game species.
48	The ability to identify and utilize state-of-the-art wildlife management techniques for major game species.
49	To understand the importance of indicator species habitat requirements when preparing and implementing management strategies.
50	The ability to determine and identify species-specific habitat requirements.
51	The ability to determine and identify species specific limiting factors.
52	The ability to determine and identify species-specific predator/prey relationships.
53	The ability to determine and identify species-specific agricultural depredation potentials.
54	To have knowledge of the life history requirements for waterfowl.
55	The ability to implement waterfowl surveys.
56	To have knowledge of waterfowl management techniques.
57	To have knowledge of shorebird life history.
58	The ability to implement survey techniques for shorebirds.
59	To have knowledge of shorebird management techniques.
60	To have knowledge of the life history requirements for various migratory birds.
61	The ability to implement survey techniques for migratory neotropical birds.
62	To be knowledgeable of white-tailed deer management techniques.
63	The ability to implement survey techniques for members of the Cervidae family.
64	To be knowledgeable of wildlife habitat management principles, tools, and techniques.
65	The ability to implement and assess the impacts of management on target and non-target species.
66	The ability to implement and assess habitat management techniques on target and non-target species habitat.
67	The ability to implement and assess prescribed fire for habitat restoration and management.
68	The ability to implement water level management strategies for habitat restoration and management.
69	To have basic knowledge of forest management practices.
70	The ability to implement forest management and silvicultural practices for wildlife habitat restoration, maintenance, and management.
71	The ability to use current methods of plant eradication to control invasive exotic species for habitat restoration and management.
72	To have a sound foundation in botany.
73	To understand the basic principles of plant physiology.
74	To have basic knowledge of the taxonomy of spermatophytes.
75	To have basic knowledge and skills of dendrology (keying, collecting, preserving, and ageing plants).
76	The ability to key-out regional and national plant species.
77	The ability to locate species-specific plant life history and determine plant species value to wildlife.
78	The ability to locate and interpret reliable information.

(Table cont.)

79	The ability to identify, classify, and compare plant communities by implementing plant surveying and mapping techniques (e.g. Daubenmire habitat method).
80	The ability to identify the successional stage of a plant community.
81	The ability to identify the current successional stage of a plant community and predict the wildlife inhabitants.
82	The ability to identify wetland plant species and community composition to determine the wetland ecosystem type.
83	The ability to manage green tree and moist soil units for target species and species diversity.
84	To have knowledge of wetland ecology and management.
85	The ability to develop, implement, and manage an adaptive resource habitat management plan.
86	The ability to use the internet and computer as tools to aid in biological/habitat management.
87	The ability to implement adaptive resource management to evaluate habitat response and future management options.
88	To be knowledgeable in forest ecology and management.
89	To have knowledge of forest management with emphasis on hardwood management.
90	To have knowledge of forest management techniques that pertains to forest dwelling migratory birds.
91	The ability to age various wildlife species by locating and implementing species-specific techniques.
92	The ability to age deer by dental wear.
93	The ability to sex wildlife.
94	The ability to trap wildlife.
95	The ability to handle wildlife.
96	The ability to visually and auditorially identify wildlife.
97	The ability to identify wildlife habitat use by wildlife sign.
98	The ability to administer proper animal care through animal husbandry techniques and contemporary knowledge of animal welfare issues.
99	To have knowledge of plant evolution, which includes ecological, genetic and molecular techniques.
100	To have knowledge of animal evolution, which includes ecological, genetic and molecular techniques.
101	The ability to merge the management principles of upland, wetland, and aquatic systems to meet wildlife management and biodiversity objectives.
102	The ability to apply ecological concepts and models to problems in natural resource and ecosystem management.
103	To have knowledge of agrostology for the study of grasses and grassland habitat management.
104	To be familiar with localized endangered and threatened species.
105	To have knowledge of basic land uses (e.g. aquaculture, crop production, forestry, grazing, and wildlife).
106	To have knowledge of coniferous ecosystems.
107	To have knowledge of fish biology and management.

Round One Physical Sciences Entry-Level Job Skills.--Listed in Table 2 are the unique entry-level job skills identified by the Delphi Panel in the physical sciences area. A total of 35 items were identified by the panel members that were judged by the researcher to have some unique aspect or component. Since there was no meaningful priority for items submitted through the open-ended responses of the Round One instrument, the items were ordered as the Round One instruments were received from the panelists.

Table 2. Entry-Level Physical Science Job Skills Needed by Wildlife Management Professionals Identified by Wildlife Management Experts in a Round One Delphi Survey.

	Physical Sciences Entry-Level Job Skills
1	To have basic knowledge of agronomy (soil characteristics, identification, and productivity).
2	The ability to manage the soil for improved environmental and economic productivity.
3	The ability to use contemporary soil erosion control techniques within the wildlife management area.
4	The ability to understand a soil analysis and determine fertilizer and lime recommendations.
5	The ability to identify non-wetland and wetland soil types by soil characteristics, soil maps, and imagery.
6	To have a basic knowledge of hydrology.
7	The ability to use soil type and topography to assess the hydrologic regime.
8	The ability to use surface soils, sub-surface soils, and topography information to assess surface water retention, ground water components, and hydrologic cycles for wildlife management planning.
9	The ability to monitor and interpret basic soil and water models to estimate sediment yield, water quality, and water heating.
10	To have knowledge of basic water quality monitoring techniques.
11	To understand the relationship between soil type, soil fertility, soil hydrology, and plant community to assess ecosystem cycling, productivity, and distribution.
12	To understand the relationship between abiotic factors (climate, hydrology, soils) and biotic productivity and diversity.
13	The ability to use plant community indices to determine wildlife habitat value.
14	To understand the relationships between geography and ecosystems.
15	To understand and recognize the relationships between geology and ecosystems of the work area, district and region.
16	To recognize and understand the relationship between climate and ecosystems.
17	The ability to use basic meteorological monitoring equipment and apply meteorological data for wildlife management planning.
18	To recognize and understand the relationship between regionalized weather patterns

(Table cont.)

	(daily, seasonal, and long-term patterns) and weather impacts on wildlife.
19	To recognize and understand the relationship between elevation and ecosystem diversity.
20	The ability to implement and assess appropriate aquatic habitat management techniques.
21	The ability to identify, locate, implement, and assess site-specific controls for non-point source pollution to improve water quality.
22	The ability to assess current and potential wildlife productivity in upland habitats.
23	The ability to determine the suitability of land for agronomic production.
24	The ability to implement and manage moist soil unit plant productivity.
25	The ability to assess and implement irrigation techniques for land use.
26	The ability to apply wildfire risk assessment models to "species at risk."
27	The ability to effectively manage prescribed fire to protect air quality.
28	To have a basic knowledge of physical and organic chemistry to aid with chemical applications (fertilizer, herbicides, and pesticides).
29	To have knowledge of water chemistry and water quality sampling methods.
30	The ability to monitor water quality using direct and remote automated equipment for wildlife management planning.
31	To have knowledge of organic and biochemistry with specific information on toxicology and environmental health.
32	The ability to map and inventory a watershed.
33	To have a practical understanding of meteorology.
34	To have the basic knowledge of organic chemistry.
35	To have the basic knowledge of inorganic chemistry.

Round One Basic Statistics Entry-Level Job Skills.--Listed in Table 3 are the unique entry-level job skills identified by the Delphi panel in the basic statistics area. A total of 27 items were identified by the panel members that were judged by the researcher to have some unique aspect or component. Since there was no meaningful priority for items submitted through the open-ended responses of the Round One instrument, the items are ordered as the Round One instruments were received from the panelists.

Table 3. Entry-Level Basic Statistics Job Skills Needed by Wildlife Management Professionals Identified by Wildlife Management Experts in a Round One Delphi Survey.

	Basic Statistics Entry-Level Job Skills
1	The ability to use descriptive statistics in the biometric analysis of wildlife phenomenon.
2	To have a basic understanding of statistical methods to estimate wildlife populations.
3	To be familiar with SAS (Statistical Analysis Systems).
4	The ability to understand basic (inferential) statistical concepts.
5	The ability to conduct simple analysis with guidance from a scientist or biometrician.

(Table cont.)

6	To be able to read and understand complex research designs.
7	To be able to read and understand reports that utilizes advanced statistical concepts (ANCOVA, Logistic Regression, etc.).
8	The ability to perform routine analysis of raw data using descriptive statistics.
9	The ability to understand the assumptions of parametric and non-parametric statistics.
10	To understand the application of statistics to wildlife management and research.
11	The ability to apply the concepts of accuracy, precision and the scientific method for hypothesis testing.
12	The ability to read and interpret scientific articles to understand the study results.
13	The ability to use statistics to plan, implement, and assess science-based wildlife management programs (adaptive resource management).
14	To understand the effect of sample size on research findings and management outcomes.
15	To have knowledge of sampling principles for assessing wildlife populations and wildlife habitat.
16	To understand the value of scientific survey sampling in wildlife management.
17	The ability to determine the appropriate sample size for wildlife research and adaptive resource management.
18	To understand the basic variables and relationships of wildlife population dynamics.
19	The ability to recognize a statistically valid sample versus some "neat information."
20	The ability to use statistical software packages to record and evaluate data.
21	The ability to implement population-adaptive harvest management techniques.
22	The ability to statistically analyze population data to determine population growth and recruitment potential.
23	The ability to design a sampling survey and analyze the survey data to estimate and monitor population trends.
24	The ability to use descriptive statistics to conduct habitat analysis and predict future habitat changes.
25	The ability to use inferential statistics to estimate home range.
26	The ability to use scientific journal writings to develop a theoretical approach to problem solving.
27	To have experience in statistical procedure and data analysis.

Round One Quantitative Sciences Entry-Level Job Skills.--Listed in Table 4 are the unique entry-level job skills identified by the Delphi Panel in the quantitative sciences area. A total of 49 items were identified by the panel members that were judged by the researcher to have some unique aspect or component. Since there was no meaningful priority for items submitted through the open-ended responses of the Round One instrument, the items are ordered as the Round One instruments were received from the panelists.

Table 4. Entry-Level Quantitative Science Job Skills Needed by Wildlife Management Professionals Identified by Wildlife Management Experts in a Round One Delphi Survey.

	Quantitative Sciences Entry-Level Job Skills
1	To understand the difference between inventorying (what's there), monitoring (what's it doing), and research (why's it doing that).
2	The ability to develop, implement, and complete comprehensive wildlife management plans for individual species and groups of species.
3	The ability to apply classification and ordination statistics to determine ecological groupings and gradients.
4	The ability to implement and complete biodiversity assessments.
5	The ability implement risk assessments for "species at risk."
6	To be introduced to modeling as a wildlife management tool.
7	The ability to apply population models as wildlife management tools (population estimates, indices, life tables and projection, survival, band return, capture-recapture models, sightability models, and minimum viable population analysis).
8	To be familiar with general wildlife sampling methods.
9	The ability to organize survey sampling and monitoring techniques for wildlife (mammals, birds, reptiles, amphibians, fish, and invertebrates) (e.g. capture, marking, radio telemetry, sexing, ageing).
10	The ability to organize survey sampling and monitoring techniques for plants to evaluate wildlife habitat (e.g. imagery; sampling methods - transects (random, stratified, cluster), data (plots, plotless, point intercept).
11	The ability to design, implement, and interpret field surveys.
12	The ability to estimate animal populations by ground transects.
13	The ability to estimate animal populations by aerial transects.
14	The ability to plan, implement, and assess the findings of a point-center plot survey.
15	The ability to plan, implement, and assess a belt-line transect sampling design.
16	The ability to plan, implement, and assess the findings of a plot transect survey.
17	The ability to plan, implement, and assess the findings of a browse survey.
18	The ability to plan, implement, and assess the findings of a public opinion survey (questionnaires).
19	The ability to plan, implement, and assess the findings of random transect sampling.
20	The ability to identify the pertinent factors which affect a transect sampling route.
21	The ability to identify all plants and plant communities within a sampling point.
22	The ability to identify soil types and characteristics within a sampling point.
23	The ability to conduct deer surveys using current technology.
24	The ability to conduct waterfowl surveys utilizing current technology.
25	The ability to conduct shorebird surveys using current technology.
26	The ability to conduct woodcock surveys using current technology.
27	The ability to conduct mourning dove surveys using current technology.
28	The ability to conduct rail surveys using current technology.
29	The ability to use, develop, or adapt habitat suitability index models to estimate habitat quality and potential.
30	The ability to implement a species-specific population viability analysis.

(Table cont.)

31	To have the basic knowledge and familiarity with modern surface mapping and remote sensing techniques to include computer usage, GIS, GPS, aerial photography, satellite imagery, and cartography to model, monitor, and assess natural resources.
32	The ability to estimate and identify surface features through aerial photograph interpretation.
33	The ability to use GIS, GPS, aerial photography, cartography, and map reading for natural resource management planning, monitoring, and assessment.
34	The ability to use basic land surveying techniques (e.g. shooting elevations, determining boundaries, setting grade, road construction, logging systems).
35	To have knowledge of spatial and temporal landscape analysis.
36	To be familiar with various radio telemetry techniques.
37	To develop critical quantitative thinking skills by completing math courses through college calculus.
38	To develop critical quantitative thinking skills by completing math courses through college algebra.
39	To develop critical quantitative thinking skills by completing math courses through college trigonometry.
40	To develop critical quantitative thinking skills by completing college physics.
41	The ability to use timber inventory sampling techniques that are commonly used in modern forest management.
42	The ability to implement variable-plot tree cruising using a Relaskop instrument.
43	To have a broad understanding of vegetative sampling techniques commonly used in modern land management activities.
44	To have knowledge of the agriculture/wild land interface.
45	To have knowledge of the urban/wild land interface.
46	To have knowledge of grassland/rangeland inventory techniques.
47	To have knowledge of silvicultural biometrics.
48	To have basic computational skills.
49	The ability to accurately measure and record data.

Round One Humanities Entry-Level Job Skills.--Listed in Table 5 are the unique entry-level job skills identified by the Delphi panel in the humanities area. A total of 32 items were identified by the panel members that were judged by the researcher to have some unique aspect or component. Since there was no meaningful priority for items submitted through the open-ended responses of the Round One instrument, the items are ordered as the Round One instruments were received from the panelists.

Table 5. Entry-Level Humanities Job Skills Needed by Wildlife Management Professionals Identified by Wildlife Management Experts in a Round One Delphi Survey.

	Humanities Entry-Level Job Skills
1	The ability to understand diverse wildlife values and use that information to design and implement environmental education and/or outreach programs.
2	The ability to understand and apply human social, demographic, economic, and political implications as related to wildlife law, sustainable resources, management, harvest, conservation, preservation, and assessment.
3	The ability to understand public perception of wildlife and associated habitats.
4	To understand and appreciate diverse human cultures and associated wildlife value systems.
5	The ability to understand historical and contemporary roles of society in wildlife management.
6	The ability to understand historical and contemporary roles of society in forest management.
7	The ability to recognize human need for outdoor recreation and to understand the apparent implications if that need is denied or suppressed (conflict management).
8	The ability to recognize the history, role, and importance of consumptive wildlife use (hunting, fishing, and trapping) as a wildlife conservation/management tool.
9	The ability to understand the traditions, culture, and heritage surrounding consumptive values such as hunting, fishing, and trapping.
10	The ability to recognize the social implications of wildlife management actions and pre-planning responses to questions and challenges made by those who do not understand or support hunting as a wildlife management tool.
11	The ability to recognize, understand, and appreciate diverse cultural perspectives regarding wildlife values (stakeholder diversity).
12	The ability to recognize the value of human diversity in the workplace.
13	The ability to work professionally in order to be accepted as professionals by future society.
14	The ability to recognize and understand diverse cultural natural resource values.
15	The ability to understand the need for social acceptance of consumptive natural resource use (hunting, trapping, and fishing).
16	The ability to relate wildlife or habitat trends to human dynamics.
17	To have a foundation of wildlife conservation and land management history.
18	The ability to understand that changing U.S. demographics will impact future wildlife management.
19	To recognize the impact of giving animals human traits by TV and other media, which will affect society's acceptance of consumptive wildlife use (hunting and trapping).
20	The ability to apply real world economics and capitalism in wildlife management.
21	The ability to apply macro and microeconomics concepts to wildlife management.
22	To have knowledge of political science.
23	The ability to recognize how diverse social values affect wildlife management decisions.
24	To have an understanding of conservation biology.
25	The ability to develop and maintain partnerships in wildlife management.

(Table cont.)

26	The ability to function as a well-rounded member of society.
27	The ability to understand "anti-group stakeholders" (e.g. PETA) and their perspectives.
28	The ability to understand private landowner needs and their relationship to wildlife and land management.
29	The ability to develop personal environmental ethics and a resource philosophy.
30	To have knowledge of political and social history at the local, state, and national level, which involve wildlife management.
31	To be familiar with global historic and contemporary wildlife issues.
32	The ability to locate and retrieve reliable wildlife information from the library and internet resources.

Round One Communications Entry-Level Job Skills.--Listed in Table 6 are the unique entry-level job skills identified by the Delphi panel in the communications area. A total of 42 items were identified by the panel members that were judged by the researcher to have some unique aspect or component. Since there was no meaningful priority for items submitted through the open-ended responses of the Round One instrument, the items are ordered as the Round One instruments were received from the panelists.

Table 6. Entry-Level Communication Job Skills Needed by Wildlife Management Professionals Identified by Wildlife Management Experts in a Round One Delphi Survey.

	Communications Entry-Level Job Skills
1	The ability to be an effective public speaker.
2	The ability to professionally present information to a group of peers.
3	The ability to use software programs (e.g. PowerPoint) to construct one-on-one, lay-groups, professional, and web-based presentations to reach a diversity of audiences.
4	The ability to avoid or resolve potential human conflict situations with the most effective and appropriate conflict resolution methods.
5	The ability to use informed consent to effectively accomplish the mission, when consensus development is ineffective.
6	The ability to resolve conflict through consensus building.
7	The ability to skillfully communicate with diverse groups and individuals.
8	The ability to write a simple technical report.
9	The ability to professionally and effectively communicate one-on-one at any level of understanding (technical and lay person).
10	The ability to explain complex issues to layman stakeholders.
11	The ability to effectively present a professional presentation to a large audience.
12	The ability to effectively manage diverse visitors or user groups.
13	The ability to speak to a group of people in a variety of forms and formats.
14	The ability to interact well with stakeholder groups.
15	The ability to effectively manage and interact with diverse staff personnel.

(Table cont.)

16	The ability to deal with and discuss controversial issues in an hostile environment.
17	The ability of the natural resource manager to effectively work with stakeholders through contemporary public relation practices.
18	The ability to articulate natural resource knowledge and management intent to the public in an understandable manner, which requires understanding the audience's perspective.
19	The ability to communicate points convincingly to the public in print.
20	The ability to write effectively for various audiences.
21	The ability to communicate scientific information to managers and scientists with sound technical writing skills.
22	The ability to communicate through written professional correspondence.
23	The ability to write plans, reports, technical papers, and other documents using good grammar, punctuation, and techniques.
24	The ability to effectively communicate ideas and technical information through popular publications.
25	The ability to speak with the media and get your most important message across in a 30 second sound bite.
26	The ability to summarize and effectively communicate information through charts and figures for presentation and publication.
27	The ability to be an effective and responsive active listener.
28	The ability to develop and maintain interpersonal relationships.
29	The ability to be a team player and recognize the role of effective teamwork in organizations.
30	The ability to lead and follow as the situation warrants.
31	The ability to effectively network and interact with diversified groups (e.g. public, private, academic, media).
32	The ability to keep a positive, friendly, and outgoing attitude.
33	The ability to use specific knowledge to interact, influence, and communicate with community groups (action leaders, opinion leaders, etc.).
34	The ability to write grants.
35	The ability to communicate through good telephone etiquette.
36	The ability to interact, communicate, and respond with others on a daily basis to facilitate effective "win-win" situation.
37	The ability to use marketing principles and effectively communicate ideas through educational and awareness programs to stakeholders.
38	The ability to edit and critically review communication media (manuscripts and presentations).
39	The ability to work with difficult people.
40	The ability to email correspondence.
41	The ability to navigate and locate information on the internet.
42	The ability to communicate using computer technology.

Round One Policy Administration Entry-Level Job Skills.--Listed in Table 7 are the unique entry-level job skills identified by the Delphi panel in the policy administration area. A total of 38 items were identified by the panel members that were judged by the researcher to have some unique aspect or component. Since there was no meaningful priority for items submitted through the open-ended responses of the Round One instrument, the items are ordered as the Round One instruments were received from the panelists.

Table 7. Entry-Level Policy Administration Job Skills Needed by Wildlife Management Professionals Identified by Wildlife Management Experts in a Round One Delphi Survey.

	Policy Administration Entry-Level Job Skills
1	The ability to understand the agency mission statement and the employee's contribution to accomplish the agency mission.
2	The ability to possess a working knowledge of local, state, and national political and legislative processes to effectively accomplish organizational goals.
3	The ability to apply basic knowledge of business administration and management in the workplace.
4	The ability to apply basic budgeting and accounting skills in the workplace.
5	The ability to effectively understand workplace policy regarding employee supervision, hiring, firing, EEO, and budgeting.
6	The ability to apply sensitivity training in the workplace.
7	The ability to understand the various roles and responsibilities of federal and state government at the executive, legislative, and judicial levels.
8	To possess the basic knowledge of the origin and relevance of wildlife regulations.
9	The ability to understand how state legislative processes impact the agency's mission.
10	The ability to understand how the federal legislative processes impact an agency's mission.
11	The ability to formulate public use regulations.
12	The ability to interpret and apply laws and policy to agency natural resource programs.
13	The ability to interpret and apply regulation and policy in practical situations.
14	The ability to recognize the differences between law, policy, and guidelines.
15	The ability to understand the structure and function of state agency administrations.
16	The ability to understand the structure and function of federal agency administrations.
17	The ability to understand the roles and responsibilities of various local, state, and federal agencies.
18	The ability to identify key governmental administrators that formulate wildlife policy.
19	The ability to electronically and manually locate and understand local, state, and federal regulations that pertain to wildlife management.
20	The ability to reference legal codes that provide the mandate for agency administration and operation.
21	To know the purpose and fundamentals of major natural resource laws (Clean Water Act, National Environmental Policy Act, Endangered Species Act, Lacey Act, Migratory Bird Treaty Act, etc.).
22	The ability to understand how federal and state threatened/endangered species laws relate to the individual's workplace, agencies, and landowners.

(Table cont.)

23	To understand how federal, state, and other organizations classify species.
24	The ability to integrate the needs of wildlife, environment, and humans with natural resource management.
25	To be exposed to the role of government regulations and the importance of compliance.
26	The ability to work within existing laws, regulations, and policies.
27	To have basic knowledge of water rights law.
28	The ability to recognize and understand state game laws.
29	To have basic knowledge of the wildlife profession, prominent wildlife leaders, and the history of wildlife legislation in the U.S.A. (wildlife profession, Aldo Leopold, Pittman-Robertson, Lacy, ESA, etc.).
30	To have basic knowledge of business law.
31	The ability to understand risk analysis and management.
32	The ability to understand how science informs policy and decision makers.
33	To have basic knowledge in law enforcement and the wildlife agent's duties.
34	To have basic knowledge of major land programs affecting wildlife.
35	To know the agencies and CEOs that affect state and federal wildlife programs.
36	To have knowledge and understanding of non-government organizations in the natural resource field and their goals.
37	To have basic knowledge and understanding of wetland regulations (Clean Water Act, Section 404, Food Securities Act, Wetland Reserve Program).
38	To have knowledge of major case histories involving controversial resource issues such as the Monongahela decision, Everglades, Columbia River dams, Chesapeake Bay pesticides, Northwest old growth forests and Northwest Forest Plan by the Clinton Administration.

Round One Practical Daily Entry-Level Job Skills.--Listed in Table 8 are the unique entry-level job skills identified by the Delphi Panel in the practical daily work skills area. A total of 53 items were identified by the panel members that were judged by the researcher to have some unique aspect or component. Since there was no meaningful priority for items submitted through the open-ended responses of the Round One instrument, the items are ordered as the Round One instruments were received from the panelists.

Table 8. Entry-Level Practical Daily Job Skills Needed by Wildlife Management Professionals Identified by Wildlife Management Experts in a Round One Delphi Survey.

	Practical Daily Entry-Level Job Skills
1	To be defensive driving certified.
2	The ability to perform routine service and emergency repair of vehicles and equipment.
3	The ability to operate a vehicle with a standard or automatic transmission.
4	The ability to maneuver a 4-wheel drive vehicle with a standard or automatic transmission.

(Table cont.)

5	The ability to maneuver a vehicle and trailer.
6	To have basic knowledge and use of various farm equipment and implements.
7	To have basic knowledge and use of heavy equipment.
8	To have knowledge of different types of hunting equipment.
9	To have knowledge of different types of fishing equipment.
10	The ability to operate a motorized boat as indicated by training certification.
11	The ability to operate an ATV as indicated by training certification.
12	To have knowledge of and safely use firearms.
13	To be first aid and CPR qualified.
14	To have basic camping and outdoor survival skills.
15	The ability to navigate by GPS, map, and compass.
16	The ability to read and follow blueprints and shop drawings.
17	The ability to use computers for word processing, developing PowerPoint presentations, canned programs (Program Mark and Program Distance), database management, and statistical packages.
18	The basic ability for repair and maintenance of computers (troubleshooting for repair and maintenance).
19	The ability to use Microsoft Office Suite for word-processing, presenting, database management, and data analysis.
20	The ability to use the scientific method for basic research and problem solving in wildlife management.
21	The ability and willingness to learn new "things" in everyday life (life-long learning through reading, conferences, etc.).
22	The ability to develop and organize annual and weekly work plans.
23	The ability to fabricate metal (welding/cutting operations).
24	The ability to be an accountable and dependable self-starter who can work independently, efficiently, and safely with minimal supervision in all settings (individual, group, office, laboratory, field).
25	The ability to communicate by radio.
26	The ability to document information via camera operation.
27	To have basic knowledge and basic abilities to use hand tools for carpentry, electrical, plumbing, metal fabrication, and general maintenance.
28	To have basic knowledge of construction.
29	The ability to safely operate a chainsaw and properly fell a tree.
30	The demonstrated ability to tolerate adverse field conditions and excel under extended duty in the field.
31	The ability to apply coursework to a field setting for writing a management plan and report writing.
32	The ability to identify potential ecological problems in the field.
33	The ability to establish credibility with colleagues and the public.
34	The ability to understand habitat and population manipulation as wildlife management tools.
35	The ability to be an ethical wildlife manager.
36	The ability to develop and possess good observational skills.
37	The ability to indicate wildlife work experience on your resume (volunteer, internship,

(Table cont.)

	summer employment).
38	The ability to balance family and work.
39	The ability to maintain a good attitude. Regardless of training, attitude is the best predictor of success. Individuals who are fair and honest with others are successful. Even if an individual, with only average intelligence and training, who can effectively deal with others, will succeed better than most others.
40	The ability to understand the basics of fire and fire fighting (wild land fire training/certification: Federal s130/190).
41	The ability to operate hand-held computers.
42	The ability to locate and identify potential employment opportunities.
43	The ability to effectively manage relationships with lessees (e.g. hunting clubs).
44	The ability to manage time (time management).
45	The ability to recognize and accept goals of the employer.
46	The ability to work with management and research personnel of the public and private sectors.
47	The ability to install, maintain, and use basic field sampling equipment.
48	The ability to follow basic laboratory procedures.
49	The ability to navigate in a forest landscape using maps/photos.
50	To have experience in small aircraft and helicopters.
51	The ability to use a winch on a vehicle.
52	To have experience with wetsuits/snorkeling.
53	To have experience in fish shocking equipment.

Results of Round Two Delphi Panel Survey

The Round Two letter of instruction (Appendix I) and instrument (Appendix J) were emailed to all panel members (N = 39) on February 13, 2004. Two reminders (Appendices S and T) were forwarded on February 21, 2004 and February 27, 2004, respectively. The final response data was received on March 15, 2004, which was the first day of data analysis. The time period to collect the Round Two responses was 32 days, which was inclusive of February 13 and March 15.

The initial Round Two Delphi panel consisted of 39 members, which included 31 respondents and eight non-respondents from Round One. Initially, the Round Two panel was composed of 13 academic, 13 private, and 13 public wildlife managers. The responding Round Two Delphi panel included 32 respondents of which nine were academic, 11 were private, and 12 were public wildlife managers. One academic non-respondent from Round One responded to

Round Two. Of the seven non-respondents, one panelist (academic) requested and was excused from participation in this study due to administrative and academic workload.

In Round Two, each panelist was requested to rate each item using the following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance. These ratings were then used to rank entry-level job skills in descending order of the mean scores. To facilitate the reporting of the importance ratings provided by members of the Delphi Panel, the researcher established the following interpretive scale to be utilized with the mean ratings of each item: 5.00 to 4.50 = “High Importance;” 4.49 to 3.50 = “Substantial Importance;” 3.49 to 2.50 = “Moderate Importance;” 2.49 to 1.50 = “Low Importance;” and 1.49 to 1.00 = “No Importance.” In the case of a tie between mean scores, items were then ranked by ascending standard deviation scores. The standard deviation indicated the dispersion of panel opinion about each item. A smaller standard deviation indicated more agreement on the rated item among items with tied mean ratings and allowed for a quantitative ranking of all items.

Round Two Biological Sciences Entry-Level Job Skill Ratings.--The 107 biological job skill items were rated by the Delphi Panel using the following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.

The highest rated item “to have a strong foundation in wildlife management principles and techniques” had a mean rating of 4.94 (SD = 0.25), which placed it in the category of “high importance” (Table 9). The lowest rated item “to have knowledge of plant evolution, which includes ecological, genetic and molecular techniques” had a mean rating of 2.25 (SD = 0.80), which placed it in the category of “low importance.” Overall, nine items were rated as “high importance” (5.00 – 4.50); 59 items were rated as “substantial importance” (4.49 – 3.50); 36

items were rated as “moderate importance” (3.49 – 2.50); three items were rated as low importance (2.49 – 1.50); and no items were rated as “no importance” (1.49 – 1.00).

Table 9. Importance of Entry-Level Biological Job Skills Needed by Wildlife Management Professionals as Perceived by Wildlife Management Experts in a Round Two Delphi Survey.

Rank	Biological Sciences Entry-Level Job Skills	Med[a]	X^b	SD
1	To have a strong foundation in wildlife management principles and techniques.	5	4.94	0.25
2	To have a sound foundation in biology.	5	4.88	0.34
3	To have a sound understanding of ecological principles and concepts of the relationships between plants, animals, and the environment.	5	4.88	0.42
4	The ability to locate and interpret reliable information.	5	4.81	0.59
5	To have a sound foundation of wildlife ecological principles and processes.	5	4.72	0.63
6	To understand the need for conserving and protecting biodiversity in management planning.	5	4.65	0.61
7	To be knowledgeable of wildlife habitat management principles, tools, and techniques.	5	4.63	0.75
8	The ability to locate, read, and comprehend reliable life history knowledge of mammals, birds, reptiles, amphibians, fish, insects, and other invertebrates.	5	4.59	0.61
9	To have a basic understanding of ecology (population, community, and ecosystem).	5	4.56	0.76
10	The ability to use the internet and computer as tools to aid in biological/habitat management.	5	4.47	0.8
11	The ability to implement and assess the impacts of management on target and non-target species.	5	4.38	0.83
12	To have basic knowledge of forest management practices.	5	4.34	0.87
13	The ability to determine and identify species-specific habitat requirements.	4	4.28	0.73
14	The ability to implement and assess habitat management techniques on target and non-target species habitat.	4	4.28	0.81
15	To have a sound foundation of plant ecological principles and processes.	4.5	4.28	0.85
16	To have knowledge of basic land uses (e.g. aquaculture, crop production, forestry, grazing, and wildlife).	5	4.28	0.92
17	The ability to utilize man-made practices as useful ecological management tools (grazing, prescribed fire, herbicide application, logging, agronomic practices, etc).	4.5	4.25	0.92
18	To understand wildlife harvest management concepts and implications when developing management plans.	5	4.25	0.95

(Table cont.)

19	To be knowledgeable in forest ecology and management.	5	4.22	0.94
20	To have knowledge of techniques for estimating animal density and diversity.	4	4.19	0.64
21	To have a sound foundation in botany.	4	4.19	0.86
22	The ability to determine and identify species specific limiting factors.	4	4.19	0.9
23	To be familiar with localized endangered and threatened species.	4.5	4.19	1.03
24	To have a working understanding of population dynamic principles.	4	4.16	0.81
25	The ability to locate species specific plant life history and determine plant species value to wildlife.	4	4.16	0.81
26	To have knowledge of wetland ecology and management.	4.5	4.13	1.07
27	To have a working knowledge for ageing, sexing, trapping, capturing, handling, marking, and radio telemetry tracking of wildlife.	4	4.09	0.86
28	The ability to recognize variables and relationships within an ecosystem (plant-animal-environment).	4	4.09	0.93
29	The ability to identify and utilize state-of-the-art wildlife management techniques for major game species.	4	4.06	0.88
30	To have the basic understanding of landscape ecology for ecosystem restoration and management planning.	4	4.06	1.08
31	To have knowledge of all basic wildlife courses.	4	4.06	1.11
32	To have a sound foundation of zoology.	4	4.03	0.86
33	The ability to apply ecological concepts and models to problems in natural resource and ecosystem management.	4	4.03	0.97
34	To have basic knowledge of ornithology.	4	4.00	0.72
35	The ability to identify the current successional stage of a plant community and predict the wildlife inhabitants.	4	4.00	0.92
36	The ability to identify the successional stage of a plant community.	4	4.00	0.98
37	To have basic knowledge of mammology.	4	3.97	0.69
38	The ability to visually and auditorially identify wildlife.	4	3.97	0.86
39	To have knowledge of techniques for estimating plant density and diversity.	4	3.94	0.67
40	The ability to identify and utilize specific state-of-the-art wildlife management methods and techniques for high profile non-game species.	4	3.94	0.91
41	The ability to implement forest management and silvicultural practices for wildlife habitat restoration, maintenance, and management.	4	3.94	0.95
42	The ability to merge the management principles of upland, wetland, and aquatic systems to meet wildlife management and biodiversity objectives.	4	3.91	0.93
43	The ability to sex wildlife.	4	3.91	1.12

(Table cont.)

44	The ability to identify wildlife habitat use by wildlife sign.	4	3.88	0.91
45	To understand the importance of indicator species habitat requirements when preparing and implementing management strategies.	4	3.88	0.94
46	To have the basic understanding of wild land fire ecology.	4	3.88	0.98
47	The ability to implement adaptive resource management to evaluate habitat response and future management options.	4	3.84	0.92
48	The ability to identify mammals, birds, reptiles, amphibians, and fish to species; insects to order; other invertebrates to phyla and order through the use of a key.	4	3.84	1.08
49	To have knowledge of the factors affecting wildlife growth, reproduction, fitness, and survival including knowledge of diseases and genetics.	4	3.81	0.69
50	The ability to identify wetland plant species and community composition to determine the wetland ecosystem type.	4	3.78	0.79
51	The ability to handle wildlife.	4	3.75	0.98
52	The ability to determine and identify species-specific predator/prey relationships.	4	3.72	0.89
53	To have basic knowledge and skills of dendrology (keying, collecting, preserving, and ageing plants).	4	3.72	0.99
54	The ability to key-out an avian species.	4	3.72	1.02
55	To have knowledge of waterfowl management techniques.	4	3.72	1.08
56	To have knowledge of forest management techniques that pertain to forest dwelling migratory birds.	4	3.69	0.97
57	The ability to develop, implement, and manage an adaptive resource habitat management plan.	4	3.69	1
58	The ability to key-out regional and national plant species.	4	3.63	0.87
59	The ability to trap wildlife.	4	3.63	0.91
60	The ability to identify, classify, and compare plant communities by implementing plant surveying and mapping techniques (e.g. Daubenmire habitat method).	3.5	3.63	0.94
61	The ability to key-out vertebrate species.	3.5	3.63	1.01
62	The ability to identify, sex, and age waterfowl.	4	3.59	1.07
63	To have knowledge of the life history requirements for various migratory birds.	4	3.56	0.76
64	The ability to use current methods of plant eradication to control invasive exotic species for habitat restoration and management.	4	3.56	1.05
65	To be knowledgeable of white-tailed deer management techniques.	4	3.53	0.84

(Table cont.)

66	The ability to implement and assess prescribed fire for habitat restoration and management.	3.5	3.50	0.88
67	The ability to key-out a mammal species.	3	3.50	1.02
68	To have knowledge of forest management with emphasis on hardwood management.	3.5	3.50	1.16
69	To have knowledge of the life history requirements for waterfowl.	4	3.47	0.92
70	The ability to implement water level management strategies for habitat restoration and management.	3	3.44	1.01
71	To have an understanding of range ecology and management principles.	3	3.44	1.19
72	The ability to implement survey techniques for migratory neotropical birds.	3	3.41	0.91
73	The ability to age various wildlife species by locating and implementing species-specific techniques.	3	3.41	0.95
74	To have knowledge of coniferous ecosystems.	3.5	3.38	1.1
75	The ability to identify, sex, and age neotropical birds.	3	3.34	0.9
76	To have knowledge of the factors affecting plant growth, reproduction, fitness, and survival including knowledge of diseases and genetics.	3	3.31	0.93
77	To have knowledge of wildlife damage management principles.	3	3.31	1.06
78	To have a basic knowledge of herpetology.	3	3.28	0.63
79	To have knowledge of fish biology and management.	3	3.28	0.96
80	To have basic knowledge of mammalian reproductive physiology.	3	3.25	0.84
81	To have basic knowledge of mammalian anatomy.	3	3.25	0.92
82	To have basic knowledge of avian reproductive physiology.	3	3.25	0.95
83	The ability to identify animal sign for animal damage control assessment.	3	3.25	0.98
84	The ability to implement waterfowl surveys.	3	3.22	1.13
85	To understand the basic principles of plant physiology.	3	3.19	0.93
86	The ability to implement survey techniques for members of the Cervidae family.	3	3.19	1.03
87	The ability to age deer by dental wear.	3	3.19	1.09
88	The ability to manage green tree and moist soil units for target species and species diversity	3	3.16	1.08
89	To have knowledge of the effects of disease on wildlife growth, reproduction, fitness, and survival.	3	3.13	0.79
90	To have knowledge of shorebird management techniques.	3	3.09	1.17
91	To have knowledge of shorebird life history.	3	3.06	1.01
92	The ability to determine and identify species-specific agricultural depredation potentials.	3	3.03	1
93	To have basic knowledge of avian anatomy.	3	3.00	0.8

(Table cont.)

94	To have knowledge of the effects of genetics on wildlife growth, reproduction, fitness, and survival.	3	2.97	0.78
95	The ability to implement survey techniques for shorebirds.	3	2.91	1.23
96	The ability to key-out invertebrate species.	3	2.88	1.18
97	The ability to identify signs and symptoms of common wildlife diseases.	3	2.81	0.78
98	To have basic knowledge of mammalian physiology.	3	2.81	0.78
99	To have an understanding of modern genetic approaches in wildlife conservation.	3	2.78	0.61
100	To have basic knowledge of avian physiology.	3	2.78	0.71
101	To have basic knowledge of the taxonomy of spermatophytes.	3	2.78	1.16
102	The ability to perform basic necropsy procedures and protocol, which include sample collection and tissue storage.	2.5	2.75	1.08
103	The ability to administer proper animal care through animal husbandry techniques and contemporary knowledge of animal welfare issues.	2	2.75	1.14
104	To have a basic knowledge of entomology with emphasis in aquatic insects and tree damaging pathogens.	3	2.72	0.73
105	To have knowledge of agrostology for the study of grasses and grassland habitat management.	2	2.44	0.56
106	To have knowledge of animal evolution, which includes ecological, genetic and molecular techniques.	2	2.41	0.91
107	To have knowledge of plant evolution, which includes ecological, genetic and molecular techniques.	2	2.25	0.8

Note. Mean ratings were classified according to the following interpretive scale: 5.00 – 4.50 = high importance; 4.49 – 3.50 = substantial importance; 3.49 – 2.50 = moderate importance; 2.49 – 1.50 = low importance; and 1.49 – 1.00 = no importance.
[a]Median of ratings assigned by Delphi Panelists.
[b]Mean rating based on following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.

Round Two Physical Sciences Entry-Level Job Skill Ratings.--The 36 physical science job skill items were rated by the Delphi Panel using the following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.

The highest rated item “the ability to use plant community indices to determine wildlife habitat value” had a mean of 4.22 (SD = 0.66) (Table 10), which placed it in the category of "substantial importance." The lowest rated item "the ability to assess and implement irrigation techniques for land use" had a mean of 2.34 (SD = 1.1), which placed it in the category of "low importance." Overall, no items were rated as "high importance" (5.00 – 4.50); 10 items were rated as "substantial importance" (4.49 – 3.50); 25 items were rated as "moderate importance" (3.49 – 2.50); one item was rated as "low importance" (2.49 – 1.50); and no items were rated as "no importance" (1.49 – 1.00).

Table 10. Importance of Entry-Level Physical Science Job Skills Needed by Wildlife Management Professionals as Perceived by Wildlife Management Experts in a Round Two Delphi Survey.

Rank	Physical Sciences Entry-Level Job Skills	Med[a]	X[b]	SD
1	The ability to use plant community indices to determine wildlife habitat value.	4	4.22	0.66
2	To understand the relationship between abiotic factors (climate, hydrology, soils) and biotic productivity and diversity.	4	3.88	0.83
3	To have a basic knowledge of hydrology.	4	3.81	0.97
4	The ability to use contemporary soil erosion control techniques within the wildlife management area.	4	3.66	0.94
5	The ability to implement and assess appropriate aquatic habitat management techniques.	4	3.66	0.97
6	To have basic knowledge of agronomy (soil characteristics, identification, and productivity).	4	3.63	0.91
7	The ability to identify non-wetland and wetland soil types by soil characteristics, soil maps, and imagery.	4	3.59	0.98
8	To understand the relationship between soil type, soil fertility, soil hydrology, and plant community to assess ecosystem cycling, productivity, and distribution.	3	3.53	0.88
9	To recognize and understand the relationship between climate and ecosystems.	4	3.53	0.95
10	To understand and recognize the relationships between geology and ecosystems of the work area, district and region.	3	3.44	0.95
11	To understand the relationships between geography and ecosystems.	3	3.41	0.95
12	The ability to use soil type and topography to assess the hydrologic regime.	3	3.34	1.07

(Table cont.)

13	To recognize and understand the relationship between regionalized weather patterns (daily, seasonal, and long-term patterns) and weather impacts on wildlife.	3	3.31	0.93
14	The ability to implement and manage moist soil unit plant productivity.	3	3.25	1.16
15	To have knowledge of basic water quality monitoring techniques.	3	3.22	0.87
16	The ability to manage the soil for improved environmental and economic productivity.	3	3.22	0.91
17	To have a practical understanding of meteorology.	3	3.22	1.13
18	To recognize and understand the relationship between elevation and ecosystem diversity.	3	3.19	0.86
19	The ability to effectively manage prescribed fire to protect air quality.	3	3.19	0.90
20	The ability to map and inventory a watershed.	3	3.19	1.06
21	The ability to identify, locate, implement, and assess site-specific controls for non-point source pollution to improve water quality.	3	3.16	1.14
22	The ability to use surface soils, sub-surface soils, and topography information to assess surface water retention, ground water components, and hydrologic cycles for wildlife management planning.	3	3.13	0.94
23	To have the basic knowledge of organic chemistry.	3	3.03	1.09
24	The ability to identify, locate, implement, and assess site-specific controls for non-point source pollution to improve water quality.	3	3.00	1.08
25	The ability to understand a soil analysis and determine fertilizer and lime recommendations.	3	3.00	1.14
26	The ability to apply wildfire risk assessment models to "species at risk."	3	2.88	0.91
27	To have knowledge of water chemistry and water quality sampling methods.	3	2.88	0.94
28	To have the basic knowledge of inorganic chemistry.	3	2.84	1.02
29	The ability to determine the suitability of land for agronomic production.	3	2.81	1.00
30	To have a basic knowledge of physical and organic chemistry to aid with chemical applications (fertilizer, herbicides, and pesticides).	3	2.78	0.87
31	The ability to monitor water quality using direct and remote automated equipment for wildlife management planning.	3	2.63	0.91

(Table cont.)

32	The ability to use basic meteorological monitoring equipment and apply meteorological data for wildlife management planning.	2	2.63	0.94
33	The ability to monitor and interpret basic soil and water models to estimate sediment yield, water quality, and water heating.	2	2.59	1.07
34	To have knowledge of organic and biochemistry with specific information on toxicology and environmental health.	2	2.56	0.84
35	The ability to assess and implement irrigation techniques for land use.	2	2.34	1.10

Note. Mean ratings were classified according to the following interpretive scale: 5.00 – 4.50 = high importance; 4.49 – 3.50 = substantial importance; 3.49 – 2.50 = moderate importance; 2.49 – 1.50 = low importance; and 1.49 – 1.00 = no importance.
[a]Median of ratings assigned by Delphi Panelists.
[b]Mean rating based on following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.

Round Two Basic Statistics Entry-Level Job Skill Ratings.-- The 27 basic statistics job skill items were rated by the Delphi Panel using the following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.

The highest rated item “the ability to read and interpret scientific articles to understand the study results” had a mean of 4.69 (SD = 0.59), which placed it in the category of “high importance” (Table 11). The lowest rated item “the ability to use inferential statistics to estimate home range” had a mean of 2.69 (SD = 1.00), which placed it in the category of “low importance.” Overall, three items were rated as “high importance” (5.0 – 4.5); 19 items were rated as “substantial importance” (4.49 – 3.50); five items were rated as “moderate importance” (3.49 – 2.50); no items were rated as “low importance” (2.49 – 1.50); and no items were rated “no importance” (1.49 – 1.00).

Table 11. Importance of Entry-Level Basic Statistic Job Skills Needed by Wildlife Management Professionals as Perceived by Wildlife Management Experts in a Round Two Delphi Survey.

Rank	Basic Statistics Entry-level Job Skills	Med[a]	X[b]	SD
1	The ability to read and interpret scientific articles to understand the study results.	5	4.69	0.59
2	To understand the application of statistics to wildlife management and research.	5	4.63	0.66
3	To have knowledge of sampling principles for assessing wildlife populations and wildlife habitat.	5	4.50	0.67
4	To understand the value of scientific survey sampling in wildlife management.	5	4.47	0.72
5	To have a basic understanding of statistical methods to estimate wildlife populations.	5	4.41	0.8
6	The ability to recognize a statistically valid sample versus some "neat information."	5	4.38	0.75
7	The ability to conduct simple analysis with guidance from a scientist or biometrician.	5	4.38	0.87
8	To understand the effect of sample size on research findings and management outcomes.	4	4.25	0.84
9	The ability to apply the concepts of accuracy, precision and the scientific method for hypothesis testing.	4	4.19	0.86
10	The ability to understand basic (inferential) statistical concepts.	4.5	4.19	1.06
11	To understand the basic variables and relationships of wildlife population dynamics.	4	4.16	0.81
12	The ability to perform routine analysis of raw data using descriptive statistics.	4	4.09	1.03
13	The ability to use descriptive statistics in the biometric analysis of wildlife phenomenon.	4	3.94	1.05
14	The ability to use statistics to plan, implement, and assess science-based wildlife management programs (adaptive resource management).	4	3.91	0.69
15	To have experience in statistical procedure and data analysis.	4	3.91	0.96
16	The ability to use statistical software packages to record and evaluate data.	4	3.75	1.05
17	The ability to determine the appropriate sample size for wildlife research and adaptive resource management.	4	3.69	0.9

(Table cont.)

18	The ability to use descriptive statistics to conduct habitat analysis and predict future habitat changes.	4	3.69	0.93
19	The ability to design a sampling survey and analyze the survey data to estimate and monitor population trends.	4	3.66	1.04
20	The ability to use scientific journal writings to develop a theoretical approach to problem solving.	4	3.59	1.04
21	The ability to implement population-adaptive harvest management techniques.	4	3.56	0.91
22	The ability to statistically analyze population data to determine population growth and recruitment potential.	3	3.50	0.84
23	The ability to understand the assumptions of parametric and non-parametric statistics.	3.5	3.47	0.98
24	To be able to read and understand reports that utilize advanced statistical concepts (ANCOVA, Logistic Regression, etc.).	3	3.28	1.22
25	To be able to read and understand complex research designs.	3	3.03	1.06
26	To be familiar with SAS (Statistical Analysis System).	3	2.84	0.88
27	The ability to use inferential statistics to estimate home range.	2.5	2.69	1.00

Note. Mean ratings were classified according to the following interpretive scale: 5.00 – 4.50 = high importance; 4.49 – 3.50 = substantial importance; 3.49 – 2.50 = moderate importance; 2.49 – 1.50 = low importance; and 1.49 – 1.00 = no importance.
[a]Median of ratings assigned by Delphi Panelists.
[b]Mean rating based on following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.

Round Two Quantitative Sciences Entry-Level Job Skill Ratings.-- The 49 quantitative sciences job skill items were rated by the Delphi Panel using the following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.

The highest rated item “the ability to accurately measure and record data” had a mean of 4.88 (SD = 0.42) which placed it in the category of “high importance” (Table 12). The lowest rated item “the ability to implement variable-plot tree cruising using a Relaskop instrument” had a mean of 2.44 (SD = 0.95), which placed it in the category of “low importance.” Overall, three items were rated as “high importance” (5.00 – 4.50); 20 items were rated as “substantial importance” (4.49 – 3.50); 25 items were rated as “moderate importance” (3.49 – 2.50); one item was rated as “low importance” (2.49 – 1.50); and no items were rated as “no importance” (1.49 – 1.00).

Table 12. Importance of Entry-Level Quantitative Science Job Skills Needed by Wildlife Management Professionals as Perceived by Wildlife Management Experts in a Round Two Delphi Survey.

Rank	Quantitative Sciences Entry-Level Job Skills	Med[a]	X[b]	SD
1	The ability to accurately measure and record data.	5	4.88	0.42
2	To be familiar with general wildlife sampling methods.	5	4.81	0.4
3	To have basic computational skills.	5	4.59	0.67
4	To understand the difference between inventorying (what's there), monitoring (what's it doing), and research (why's it doing that).	5	4.47	0.72
5	To have a broad understanding of vegetative sampling techniques commonly used in modern land management activities.	4.5	4.34	0.79
6	The ability to develop, implement, and complete comprehensive wildlife management plans for individual species and groups of species.	4	4.34	0.70
7	The ability to use GIS, GPS, aerial photography, cartography, and map reading for natural resource management planning, monitoring, and assessment.	4	4.31	0.69
8	The ability to organize survey sampling and monitoring techniques for wildlife (mammals, birds, reptiles, amphibians, fish, and invertebrates) (e.g. capture, marking, radio telemetry, sexing, ageing).	4	4.22	0.66
9	The ability to organize survey sampling and monitoring techniques for plants to evaluate wildlife habitat (e.g. imagery; sampling methods - transects (random, stratified, cluster), data (plots, plotless, point intercept).	4	4.22	0.55
10	The ability to design, implement, and interpret field surveys.	4	4.19	0.74
11	To have the basic knowledge and familiarity with modern surface mapping and remote sensing techniques to include computer usage, GIS, GPS, aerial photography, satellite imagery, and cartography to model, monitor, and assess natural resources.	4	4.09	0.89
12	To have knowledge of the agriculture/wild land interface.	4	4.03	1.03

(Table cont.)

13	To have knowledge of the urban/wild land interface.	4	4.00	1.05
14	To develop critical quantitative thinking skills by completing math courses through college algebra.	4	3.81	1.06
15	To be introduced to modeling as a wildlife management tool.	4	3.81	0.74
16	The ability to estimate and identify surface features through aerial photograph interpretation.	4	3.78	0.87
17	The ability to apply population models as wildlife management tools (population estimates, indices, life tables and projection, survival, band return, capture-recapture models, sightability models, and minimum viable population analysis).	4	3.69	0.78
18	The ability to identify the pertinent factors which affect a transect sampling route.	4	3.63	0.83
19	The ability to implement and complete biodiversity assessments.	4	3.63	0.79
20	To have knowledge of spatial and temporal landscape analysis.	4	3.56	0.98
21	The ability to plan, implement, and assess the findings of random transect sampling.	3	3.53	0.88
22	To develop critical quantitative thinking skills by completing math courses through college trigonometry.	4	3.50	1.16
23	The ability to estimate animal populations by ground transects.	3	3.50	0.84
24	The ability to plan, implement, and assess the findings of a plot transect survey.	3	3.44	0.84
25	The ability to identify all plants and plant communities within a sampling point.	3	3.44	0.67
26	To be familiar with various radio telemetry techniques.	3	3.41	0.98
27	The ability to use timber inventory sampling techniques that are commonly used in modern forest management.	3	3.41	0.95
28	The ability to plan, implement, and assess the findings of a point-center plot survey.	3	3.41	0.80
29	The ability implement risk assessments for "species at risk."	3	3.41	0.71
30	To develop critical quantitative thinking skills by completing math courses through college calculus.	4	3.38	1.21
31	The ability to plan, implement, and assess the findings of a browse survey.	3	3.38	0.98
32	The ability to plan, implement, and assess a belt-line transect sampling design.	3	3.38	0.79
33	The ability to conduct waterfowl surveys utilizing current technology.	3	3.34	0.94

(Table cont.)

34	The ability to use, develop, or adapt habitat suitability index models to estimate habitat quality and potential.	3	3.34	0.83
35	The ability to conduct deer surveys using current technology.	3	3.31	0.97
36	The ability to estimate animal populations by aerial transects.	3	3.25	0.92
37	The ability to plan, implement, and assess the findings of a public opinion survey (questionnaires).	3	3.19	0.97
38	The ability to identify soil types and characteristics within a sampling point.	3	3.19	0.82
39	The ability to use basic land surveying techniques (e.g. shooting elevations, determining boundaries, setting grade, road construction, logging systems).	3	3.16	1.42
40	To have knowledge of grassland/rangeland inventory techniques.	3	3.13	0.98
41	The ability to apply classification and ordination statistics to determine ecological groupings and gradients.	3	3.06	0.95
42	To have knowledge of silvicultural biometrics.	3	3.03	0.93
43	The ability to conduct shorebird surveys using current technology.	3	3.00	1.02
44	To develop critical quantitative thinking skills by completing college physics.	3	2.97	1.12
45	The ability to implement a species-specific population viability analysis.	3	2.84	0.81
46	The ability to conduct mourning dove surveys using current technology.	3	2.72	1.02
47	The ability to conduct rail surveys using current technology.	3	2.69	1.06
48	The ability to conduct woodcock surveys using current technology.	3	2.66	1.00
49	The ability to implement variable-plot tree cruising using a Relaskop instrument.	2	2.44	0.95

Note. Mean ratings were classified according to the following interpretive scale: 5.00 – 4.50 = high importance; 4.49 – 3.50 = substantial importance; 3.49 – 2.50 = moderate importance; 2.49 – 1.50 = low importance; and 1.49 – 1.00 = no importance.

[a]Median of ratings assigned by Delphi Panelists.

[b]Mean rating based on following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.

Round Two Humanities Entry-Level Job Skill Ratings.--The 31 humanities job skill items were rated by the Delphi Panel using the following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.

The highest rated item "the ability to develop personal environmental ethics and a resource philosophy" had a mean of 4.75 (SD = 0.57), which placed it in the category of "high importance" (Table 13). The lowest rated item "the ability to apply macro and microeconomics concepts to wildlife management" had a mean of 3.38 (SD = 0.71), which placed it in the category of "low importance." Overall, five items were rated as "high importance" (5.00 – 4.50); 21 items were rated as "substantial importance" (4.49 – 3.50); five items were rated as "moderate importance" (3.49 – 2.50); no items were rated as "low importance" (2.49 – 1.50); and no items were rated as "no importance" (1.49 – 1.00).

Table 13. Importance of Entry-Level Humanities Job Skills Needed by Wildlife Management Professionals as Perceived by Wildlife Management Experts in a Round Two Delphi Survey.

Rank	Humanities Entry-Level Job Skills	Med[a]	X[b]	SD
1	The ability to develop personal environmental ethics and a resource philosophy.	5	4.75	0.57
2	The ability to locate and retrieve reliable wildlife information from the library and internet resources.	5	4.69	0.59
3	The ability to function as a well-rounded member of society.	5	4.63	0.61
4	The ability to understand private landowner needs and their relationship to wildlife and land management.	5	4.63	0.61
5	The ability to develop and maintain partnerships in wildlife management.	5	4.59	0.71
6	To have a foundation of wildlife conservation and land management history.	5	4.41	0.80
7	The ability to work professionally in order to be accepted as professionals by future society.	5	4.41	0.84
8	The ability to recognize the history, role, and importance of consumptive wildlife use (hunting, fishing, and	5	4.34	0.83

(Table cont.)

	trapping) as a wildlife conservation/management tool.			
9	The ability to understand public perception of wildlife and associated habitats.	4	4.28	0.77
10	The ability to understand the need for social acceptance of consumptive natural resource use (hunting, trapping, and fishing).	4	4.22	0.79
11	To have an understanding of conservation biology.	4	4.16	0.88
12	The ability to recognize the social implications of wildlife management actions and pre-planning responses to questions and challenges made by those who do not understand or support hunting as a wildlife management tool.	4	4.06	0.88
13	The ability to recognize, understand, and appreciate diverse cultural perspectives regarding wildlife values (stakeholder diversity).	4	4.06	0.91
14	The ability to recognize how diverse social values affect wildlife management decisions.	4	4.03	0.86
15	The ability to understand that changing U.S. demographics will impact future wildlife management.	4	4.03	0.97
16	The ability to recognize and understand diverse cultural natural resource values.	4	4.00	0.88
17	The ability to recognize the value of human diversity in the workplace.	4	4.00	0.92
18	The ability to recognize human need for outdoor recreation and to understand the apparent implications if that need is denied or suppressed (conflict management).	4	3.97	0.86
19	The ability to understand "anti-group stakeholders" (e.g. PETA) and their perspectives.	4	3.91	0.82
20	To understand and appreciate diverse human cultures and associated wildlife value systems.	4	3.84	1.11
21	To recognize the impact of giving animals human traits by TV and other media, which will affect society's acceptance of consumptive wildlife use (hunting and trapping).	4	3.84	1.11
22	To have knowledge of political and social history at the local, state, and national level, which involve wildlife management.	4	3.81	0.86
23	The ability to understand historical and contemporary roles of society in wildlife management.	4	3.78	0.79
24	The ability to apply real world economics and capitalism in wildlife management.	4	3.78	0.94

(Table cont.)

25	The ability to relate wildlife or habitat trends to human dynamics.	4	3.78	1.04
26	The ability to understand and apply human social, demographic, economic, and political implications as related to wildlife law, sustainable resources, management, harvest, conservation, preservation, and assessment.	3	3.56	0.84
27	The ability to understand diverse wildlife values and use that information to design and implement environmental education and/or outreach programs.	3	3.47	0.92
28	To be familiar with global historic and contemporary wildlife issues.	3.5	3.47	0.92
29	To have knowledge of political science.	3	3.47	0.95
30	The ability to understand historical and contemporary roles of society in forest management.	3	3.44	0.98
31	The ability to apply macro and microeconomics concepts to wildlife management.	3	3.38	0.71

Note. Mean ratings were classified according to the following interpretive scale: 5.00 – 4.50 = high importance; 4.49 – 3.50 = substantial importance; 3.49 – 2.50 = moderate importance; 2.49 – 1.50 = low importance; and 1.49 – 1.00 = no importance.
[a]Median of ratings assigned by Delphi Panelists.
[b]Mean rating based on following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.

Round Two Communications Entry-Level Job Skill Ratings.-- The 42 communications job skill items were rated by the Delphi panel using the following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.

The highest rated item “the ability to skillfully communicate with diverse groups and individuals” had a mean of 4.88 (SD = 0.34), which placed it in the category of “high importance” (Table 14). The lowest rated item “the ability to write grants” had a mean of 2.91 (SD = 0.96), which placed it in the category of “low importance.” Overall, 18 items were rated as “high importance” (5.00 – 4.50); 21 items were rated as “substantial importance” (4.49 – 3.50); two items were rated as “moderate importance” (3.49 – 2.50); no items were rated as “low importance” (2.49 – 1.50); and no items were rated as “no importance” (1.49 – 1.00).

Table 14. Importance of Entry-Level Communications Job Skills Needed by Wildlife Management Professionals as Perceived by Wildlife Management Experts in a Round Two Delphi Survey.

Rank	Communications Entry-Level Job Skills	Med[a]	X[b]	SD
1	The ability to skillfully communicate with diverse groups and individuals.	5	4.88	0.34
2	The ability to write plans, reports, technical papers, and other documents using good grammar, punctuation, and techniques.	5	4.81	0.59
3	The ability to write a simple technical report.	5	4.78	0.61
4	The ability to professionally and effectively communicate one-on-one at any level of understanding (technical and lay person).	5	4.75	0.62
5	The ability to keep a positive, friendly, and outgoing attitude.	5	4.75	0.62
6	The ability to professionally present information to a group of peers.	5	4.66	0.6
7	The ability to develop and maintain interpersonal relationships.	5	4.66	0.75
8	The ability to be a team player and recognize the role of effective teamwork in organizations.	5	4.66	0.75
9	The ability to explain complex issues to layman stakeholders.	5	4.59	0.67
10	The ability to lead and follow as the situation warrants.	5	4.59	0.84
11	The ability to interact well with stakeholder groups.	5	4.56	0.72
12	The ability to be an effective and responsive active listener.	5	4.56	0.80
13	The ability to communicate using computer technology.	5	4.53	0.72
14	The ability to write effectively for various audiences.	5	4.53	0.76
15	The ability to communicate through written professional correspondence.	5	4.53	0.76
16	The ability to be an effective public speaker.	5	4.50	0.72
17	The ability to effectively manage and interact with diverse staff personnel.	5	4.50	0.72
18	The ability to effectively network and interact with diversified groups (e.g. public, private, academic, media).	5	4.50	0.72
19	The ability to use software programs (e.g. PowerPoint) to construct one-on-one, lay-groups, professional, and web-based presentations to reach a diversity of audiences.	5	4.47	0.67

(Table cont.)

20	The ability to articulate natural resource knowledge and management intent to the public in an understandable manner, which requires understanding the audience's perspective.	5	4.44	0.84
21	The ability to communicate through good telephone etiquette.	5	4.41	0.98
22	The ability to speak to a group of people in a variety of forms and formats.	5	4.38	0.79
23	The ability to navigate and locate information on the internet.	5	4.38	0.87
24	The ability to interact, communicate, and respond with others on a daily basis to facilitate effective "win-win" situation.	5	4.38	0.91
25	The ability to communicate scientific information to managers and scientists with sound technical writing skills.	4	4.34	0.75
26	The ability to deal with and discuss controversial issues in a hostile environment.	5	4.34	0.83
27	The ability to email correspondence.	5	4.31	1.03
28	The ability to work with difficult people.	4	4.28	0.81
29	The ability to avoid or resolve potential human conflict situations with the most effective and appropriate conflict resolution methods.	4	4.25	0.80
30	The ability to communicate points convincingly to the public in print.	4	4.16	0.88
31	The ability to summarize and effectively communicate information through charts and figures for presentation and publication.	4	4.16	0.95
32	The ability to effectively manage diverse visitors or user groups.	4	4.06	0.88
33	The ability to use specific knowledge to interact, influence, and communicate with community groups (action leaders, opinion leaders, etc.).	4	4.06	1.01
34	The ability to effectively present a professional presentation to a large audience.	4	4.03	0.93
35	The ability to resolve conflict through consensus building.	4	3.97	0.82
36	The ability of the natural resource manager to effectively work with stakeholders through contemporary public relation practices.	4	3.97	1.03
37	The ability to effectively communicate ideas and technical information through popular publications.	4	3.84	0.88
38	The ability to use informed consent to effectively accomplish the mission, when consensus development is	4	3.78	0.83

(Table cont.)

	ineffective.			
39	The ability to edit and critically review communication media (manuscripts and presentations).	3.5	3.69	1.15
40	The ability to use marketing principles and effectively communicate ideas through educational and awareness programs to stakeholders.	4	3.53	1.11
41	The ability to speak with the media and get your most important message across in a 30 second sound bite.	3	3.34	1.18
42	The ability to write grants.	3	2.91	0.96

Note. Mean ratings were classified according to the following interpretive scale: 5.00 – 4.50 = high importance; 4.49 – 3.50 = substantial importance; 3.49 – 2.50 = moderate importance; 2.49 – 1.50 = low importance; and 1.49 – 1.00 = no importance.
[a]Median of ratings assigned by Delphi Panelists.
[b]Mean rating based on following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.

Round Two Policy Administration Entry-Level Job Skill Ratings.--The 42 policy administration job skill items were rated by the Delphi Panel using the following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.

The highest rated item "the ability to work within existing laws, regulations, and policies" had a mean of 4.72 (SD = 0.58), which placed it in the category of "high importance" (Table 15). The lowest rated item "to have basic knowledge of business law" had a mean of 2.41 (SD = 1.01), which placed it in the category of "low importance." Overall, two items were rated as "high importance" (5.00 – 4.50); 28 items were rated as "substantial importance" (4.49 – 3.50); seven items were rated as "moderate importance" (3.49 – 2.50); one item was rated as "low importance" (2.49 – 1.50); and no items were rated as "no importance" (1.49 – 1.00).

Table 15. Importance of Entry-Level Policy Administration Job Skills Needed by Wildlife Management Professionals as Perceived by Wildlife Management Experts in a Round Two Delphi Survey.

Rank	Policy Administration Entry-Level Job Skills	Med[a]	$\bar{X}$[b]	SD
1	The ability to work within existing laws, regulations, and policies.	5	4.72	0.58

(Table cont.)

2	The ability to understand the agency mission statement and the employee's contribution to accomplish the agency mission.	5	4.53	0.67
3	The ability to integrate the needs of wildlife, environment, and humans with natural resource management.	5	4.47	0.76
4	The ability to recognize and understand state game laws.	5	4.38	0.83
5	To know the purpose and fundamentals of major natural resource laws (Clean Water Act, National Environmental Policy Act, Endangered Species Act, Lacey Act, Migratory Bird Treaty Act, etc.).	5	4.38	0.79
6	To have basic knowledge of the wildlife profession, prominent wildlife leaders, and the history of wildlife legislation in the U.S.A. (wildlife profession, Aldo Leopold, Pittman-Robertson, Lacy, ESA, etc.).	4	4.28	0.73
7	The ability to recognize the differences between law, policy, and guidelines.	4	4.22	0.87
8	The ability to understand how federal and state threatened/endangered species laws relate to the individual's workplace, agencies, and landowners.	4	4.22	0.87
9	To have basic knowledge of major land programs affecting wildlife.	4	4.19	0.78
10	The ability to interpret and apply regulation and policy in practical situations.	4	4.16	0.77
11	To have basic knowledge and understanding of wetland regulations (Clean Water Act, Section 404, Food Securities Act, Wetland Reserve Program).	4	4.03	0.93
12	The ability to effectively understand workplace policy regarding employee supervision, hiring, firing, EEO, and budgeting.	4	3.97	1.03
13	The ability to electronically and manually locate and understand local, state, and federal regulations that pertain to wildlife management.	4	3.94	0.88
14	To possess the basic knowledge of the origin and relevance of wildlife regulations.	4	3.94	0.84
15	The ability to understand the roles and responsibilities of various local, state, and federal agencies.	4	3.94	0.84
16	To be exposed to the role of government regulations and the importance of compliance.	4	3.91	1.00
17	To have knowledge and understanding of non-government organizations in the natural resource field and their goals.	4	3.91	0.82
18	The ability to understand how science informs policy and decision makers.	4	3.84	0.95

(Table cont.)

19	The ability to interpret and apply laws and policy to agency natural resource programs.	4	3.78	1.04
20	The ability to understand how the federal legislative processes impact an agency's mission.	4	3.75	0.92
21	To understand how federal, state, and other organizations classify species.	4	3.72	1.05
22	The ability to possess a working knowledge of local, state, and national political and legislative processes to effectively accomplish organizational goals.	4	3.72	0.92
23	The ability to understand how state legislative processes impact the agency's mission.	4	3.69	1.06
24	The ability to understand the various roles and responsibilities of federal and state government at the executive, legislative, and judicial levels.	4	3.69	0.74
25	The ability to understand the structure and function of federal agency administrations.	4	3.66	1.00
26	The ability to apply sensitivity training in the workplace.	4	3.63	1.10
27	The ability to identify key governmental administrators that formulate wildlife policy.	4	3.63	1.07
28	The ability to understand the structure and function of state agency administrations.	4	3.63	1.04
29	The ability to apply basic budgeting and accounting skills in the workplace.	3.5	3.59	0.84
30	To know the agencies and CEOs that affect state and federal wildlife programs.	3	3.53	1.05
31	The ability to apply basic knowledge of business administration and management in the workplace.	3	3.34	0.90
32	To have basic knowledge in law enforcement and the wildlife agent's duties.	3	3.31	0.93
33	To have basic knowledge of water rights law.	3	3.25	1.08
34	The ability to formulate public use regulations.	3	3.19	1.12
35	To have knowledge of major case histories involving controversial resource issues such as the Monogahela decision, Everglades, Columbia River dams, Chesapeake Bay pesticides, Northwest old growth forests and Northwest Forest Plan by the Clinton Administration.	3	3.09	0.93
36	The ability to reference legal codes that provide the mandate for agency administration and operation.	3	3.00	1.27
37	The ability to understand risk analysis and management.	3	2.94	0.95
38	To have basic knowledge of business law.	2	2.41	1.01

(Table cont.)

Note. Mean ratings were classified according to the following interpretive scale: 5.00 – 4.50 = high importance; 4.49 – 3.50 = substantial importance; 3.49 – 2.50 = moderate importance; 2.49 – 1.50 = low importance; and 1.49 – 1.00 = no importance.
[a]Median of ratings assigned by Delphi Panelists.
[b]Mean rating based on following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.

Round Two Practical Daily Entry-Level Job Skill Ratings.--The 53 practical daily job skill items were rated by the Delphi Panel using the following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.

The highest rated item “the ability to be an ethical wildlife manager” had a mean of 4.94 (SD = 0.25), which placed it in the category of “high importance” (Table 16). The lowest rated item “the ability to fabricate metal (welding/cutting operations)” had a mean of 1.81 (SD = 0.82), which placed it in the category of “low importance.” Overall, 14 items were rated as “high importance” (5.00 – 4.50); 17 items were rated as “substantial importance” (4.49 – 3.50); 17 items were rated as “moderate importance” (3.49 – 2.50); five items were rated as “low importance” (2.49 – 1.50); and no items were rated as “no importance” (1.49 – 1.00).

Table 16. Importance of Entry-Level Practical Daily Job Skills Needed by Wildlife Management Professionals as Perceived by Wildlife Management Experts in a Round Two Delphi Survey.

Rank	Practical Daily Job Skill Items	Med[a]	X[b]	SD
1	The ability to be an ethical wildlife manager.	5	4.94	0.25
2	The ability to establish credibility with colleagues and the public.	5	4.84	0.37
3	The ability to maintain a good attitude. Regardless of training, attitude is the best predictor of success. Individuals who are fair and honest with others are successful. Even if an individual, with only average intelligence and training, who can effectively deal with others, will succeed better than most others.	5	4.84	0.37

(Table cont.)

4	The ability to be an accountable and dependable self-starter who can work independently, efficiently, and safely with minimal supervision in all settings (individual, group, office, laboratory, field).	5	4.84	0.45
5	The ability to develop and possess good observational skills.	5	4.84	0.45
6	The ability and willingness to learn new "things" in everyday life (life-long learning through reading, conferences, etc.).	5	4.81	0.40
7	The ability to balance family and work.	5	4.81	0.40
8	The ability to understand habitat and population manipulation as wildlife management tools.	5	4.81	0.47
9	The ability to manage time (time management).	5	4.78	0.49
10	The ability to recognize and accept goals of the employer.	5	4.72	0.52
11	The ability to use computers for word processing, developing PowerPoint presentations, canned programs (Program Mark and Program Distance), database management, and statistical packages.	5	4.72	0.58
12	The ability to apply coursework to a field setting for writing a management plan and report writing.	5	4.59	0.61
13	The ability to work with management and research personnel of the public and private sectors.	5	4.59	0.61
14	The ability to identify potential ecological problems in the field.	5	4.50	0.57
15	The ability to use the scientific method for basic research and problem solving in wildlife management.	5	4.44	0.76
16	The ability to develop and organize annual and weekly work plans.	5	4.31	0.86
17	The ability to navigate by GPS, map, and compass.	4.5	4.25	0.88
18	The demonstrated ability to tolerate adverse field conditions and excel under extended duty in the field.	4.5	4.25	0.92
19	The ability to navigate in a forest landscape using maps/photos.	5	4.22	1.04
20	The ability to indicate wildlife work experience on your resume (volunteer, internship, summer employment).	4	4.13	0.79
21	The ability to operate a vehicle with a standard or automatic transmission.	4	4.13	0.94
22	The ability to maneuver a 4-wheel drive vehicle with a standard or automatic transmission.	4	4.06	0.95
23	The ability to install, maintain, and use basic field sampling equipment.	4	4.00	0.80

(Table cont.)

24	The ability to use Microsoft Office Suite for word-processing, presenting, database management, and data analysis.	4	3.88	1.10
25	The ability to maneuver a vehicle and trailer.	4	3.78	1.01
26	To have knowledge of and safely use firearms.	4	3.75	1.27
27	The ability to locate and identify potential employment opportunities.	3.5	3.66	1.12
28	To have basic camping and outdoor survival skills.	4	3.63	1.07
29	To have knowledge of different types of hunting equipment.	4	3.59	1.04
30	The ability to follow basic laboratory procedures.	3.5	3.53	1.08
31	The ability to effectively manage relationships with lessees (e.g. hunting clubs).	3	3.53	1.24
32	The ability to operate an ATV as indicated by training certification.	4	3.44	1.24
33	To be first aid and CPR qualified.	3	3.41	1.24
34	The ability to perform routine service and emergency repair of vehicles and equipment.	3	3.38	0.91
35	The ability to use a winch on a vehicle.	3	3.31	1.12
36	To have basic knowledge and use of various farm equipment and implements.	3	3.28	1.02
37	The ability to operate a motorized boat as indicated by training certification.	3	3.28	1.28
38	The ability to operate hand-held computers.	3	3.25	0.88
39	The ability to document information via camera operation.	3	3.22	0.97
40	The ability to understand the basics of fire and fire fighting (wild land fire training/certification: Federal s130/190).	3	3.19	0.97
41	To have knowledge of different types of fishing equipment.	3	3.19	1.06
42	To have basic knowledge and basic abilities to use hand tools for carpentry, electrical, plumbing, metal fabrication, and general maintenance.	3	3.13	1.10
43	The ability to communicate by radio.	3	3.03	1.23
44	The ability to safely operate a chainsaw and properly fell a tree.	3	2.94	1.16
45	The ability to read and follow blueprints and shop drawings.	3	2.91	1.03
46	To be defensive driving certified.	3	2.88	1.21
47	To have basic knowledge of construction.	3	2.88	1.24
48	To have basic knowledge and use of heavy equipment.	2	2.5	1.14

(Table cont.)

49	The basic ability for repair and maintenance of computers (troubleshooting for repair and maintenance).	2	2.22	0.75
50	To have experience in small aircraft and helicopters.	2	2.19	0.82
51	To have experience in fish shocking equipment.	2	2.06	0.91
52	To have experience with wetsuits/snorkeling.	2	1.97	1.00
53	The ability to fabricate metal (welding/cutting operations).	2	1.81	0.82

Note. Mean ratings were classified according to the following interpretive scale: 5.00 – 4.50 = high importance; 4.49 – 3.50 = substantial importance; 3.49 – 2.50 = moderate importance; 2.49 – 1.50 = low importance; and 1.49 – 1.00 = no importance.
[a]Median of ratings assigned by Delphi Panelists.
[b]Mean rating based on following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.

Round Two Summary of all Entry-Level Job Skills.--Overall, 382 entry level job skill items were rated by the Delphi Panel using the following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance. The items were ranked by mean and classified by the interpretive scale: 5.00 – 4.50 = "high importance"; 4.49 – 3.50 = "substantial importance"; 3.49 – 2.50 = "moderate importance"; 2.49 – 1.50 = "low importance"; and 1.49 – 1.00 = "no importance" (Appendix U).

Two items were tied for the number one rating with a mean of 4.94 (SD = 0.25) (Appendix U). The items were "to have a strong foundation in wildlife management principles and techniques" and "the ability to be an ethical wildlife manager." The lowest rated item "the ability to fabricate metal (welding/cutting operations)" had a mean of 1.81(SD = 0.82). Overall 54 items were rated as "high importance" (5.00 – 4.50); 196 items were rated as "substantial importance" (4.49 – 3.50); 122 items were rated as "moderate importance" (3.49 – 2.50); 11 items were rated as "low importance" (2.49 – 1.50), and no items were rated as no importance (1.49 – 1.00).

Results of Round Three Delphi Panel Survey

Since Round Three of the Delphi survey involved panelists reviewing their ratings of the importance of the identified job skills in relation to the overall ratings of the total group, panel members who did not respond to the Round Two survey in which the initial importance ratings were established were not included in the Round Three survey. Therefore, the Round Three panel was composed of 32 Round Two respondents. Seven Round Two non-respondents were excluded from Round Three.

The initial Round Three Delphi panel was composed of 32 members, which consisted of nine academic, 10 private, and 12 public wildlife management experts. The responding Round Three Delphi panel totaled to 31 respondents of which nine were academic, 10 were private, and 12 were public wildlife managers. One private sector panelist who responded to the Round Two survey did not respond to the Round Three survey instrument.

The Round Three letter of instruction (Appendix K) and instrument (Appendix L) were emailed to the Round Two respondents on March 26, 2004. A follow-up telephone call was made to each panelist on April 1, 2004. The final response data was received on April 8, 2004, which was the first day of data analysis. The time period to collect the Round Three data was 14 days, which was inclusive of March 26 and April 8.

The letter of instruction thanked the Round Three panel members for their perseverance and leadership. Each panel member's Round Three instrument was unique and required a personal password for each panel member to access his or her unique instrument. Each panelist's sub-instrument included his or her Round Two rating and the overall group median for each item. If the panelist's rating was within one scale rating of the median (± 1), his or her item rating was considered in consensus and did not require further attention although respondents could change ratings if they chose to do so. However, items that were not in consensus were highlighted in yellow. The panelists were requested to re-examine the yellow highlighted items, and take one of the following two actions: 1) rate the item within one scale interval of the median; or 2) provide a brief explanation as to why his or her rating was more accurate. The panelists were requested to complete the Round Three sub-instruments by email within five working days.

The entry-level job skill items were ranked within each entry-level job skill area, and all items were ranked in one listing that included all entry-level job skill areas. The total number of entry-level job skills were 384. The median, mean, standard deviation, and level of consensus were calculated for each item. Each item was ranked by mean in descending order, then by magnitude of the standard deviation in ascending order, and finally by the level of consensus, which was the percentage of panelist's ratings that were within $\pm$ 1 of the median.

The entry-level job skill items were ranked from the highest to the lowest group mean. In the case of tied mean scores, the item with the lowest standard deviation was ranked higher (Gaspard 1992). In the case of tied means and standard deviations among items, consensus level was used to break the tie. Consensus and consensus level were calculated by dividing the number of panelists who were within $\pm$ 1 of the median by the total panelists. An item was determined to have reached consensus if at least 51% of the responding panelists rated the item within + 1 point of the median rating. This definition of consensus was established a priori. All 384 entry-level job skills were determined to have reached consensus.

At the suggestion of one panelist's opinion in Round Two, biological item # 35 and practical daily work skill item # 36 were restructured to more appropriately represent the objective content of the items in Round Three. However, since this was the suggestion of only one panel member, both the original items and the restructured items were included in the Round

Three survey instrument. This action was implemented to avoid the possibility of deleting another panelist's input by eliminating the original item.

Biological item 35 stated "to understand the need for conserving and protecting biodiversity in management planning," which was restructured to state "to have well grounded training in conservation and protection of biodiversity in management planning."

Practical daily work skill item 36 stated "the ability to be an ethical wildlife manager," which was restructured to state "to have grounded training in conservation ethics issues."

Round Three Biological Entry-Level Job Skill Ratings.--One hundred eight biological job skill items were rated by the Delphi panel using the following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance (Table 17). The items were then ranked by mean and classified using the following interpretive scale: 5.00 – 4.50 = "high importance"; 4.49 – 3.50 = "substantial importance"; 3.49 – 2.50 = "moderate importance"; 2.49 – 1.50 = "low importance"; and 1.49 – 1.00 = "no importance".

The highest rated item "To have a strong foundation in wildlife management principles and techniques" had a mean of 4.97 (SD = 0.18) and a 100% level of consensus. The lowest rated item "To have knowledge of plant evolution, which includes ecological, genetic and molecular techniques" had a mean of 2.16 (SD = 0.73) and a 100% level of consensus. Overall 13 items were rated as "high importance" (5.00 – 4.50); 53 items were rated as "substantial importance" (4.49 – 3.50); 39 items were rated as "moderate importance" (3.49 – 2.50); three items were rated as "low importance" (2.49 – 1.50); and no items were rated as "no importance" (1.49 – 1.00).

Table 17. Importance of Biological Entry-Level Job Skills Needed by Wildlife Management Professionals as Perceived by Wildlife Management Experts in a Round Three Delphi Survey.

Rank	Item	Job Skill Area[a]	Med[b]	X[c]	SD	%[d]
1	To have a strong foundation in wildlife management principles and techniques.	Biological Sciences	5	4.97	0.18	100
2	To have a sound understanding of ecological principles and concepts of the relationships between plants, animals, and the environment.	Biological Sciences	5	4.94	0.25	100
3	The ability to locate and interpret reliable information.	Biological Sciences	5	4.9	0.30	100
4	To have a sound foundation in biology.	Biological Sciences	5	4.87	0.34	100
5	To have a sound foundation of wildlife ecological principles and processes.	Biological Sciences	5	4.84	0.37	100
6	To be knowledgeable of wildlife habitat management principles, tools, and techniques.	Biological Sciences	5	4.84	0.37	100
7	To understand the need for conserving and protecting biodiversity in management planning.	Biological Sciences	5	4.74	0.44	100
8	To have a basic understanding of ecology (population, community, and ecosystem).	Biological Sciences	5	4.74	0.44	100
9	The ability to use the internet and computer as tools to aid in biological/habitat management.	Biological Sciences	5	4.65	0.49	100
10	The ability to locate, read, and comprehend reliable life history knowledge of mammals, birds, reptiles, amphibians, fish, insects, and other invertebrates.	Biological Sciences	5	4.65	0.55	96.7
11	The ability to implement and assess the impacts of management on target and non-target species.	Biological Sciences	5	4.61	0.50	100
12	To have a sound foundation of plant ecological principles and processes.	Biological Sciences	5	4.52	0.57	96.7

(Table cont.)

13	To have knowledge of basic land uses (e.g. aquaculture, crop production, forestry, grazing, and wildlife).	Biological Sciences	5	4.52	0.57	96.7
14	To have knowledge of wetland ecology and management.	Biological Sciences	5	4.48	0.57	96.7
15	To have basic knowledge of forest management practices.	Biological Sciences	5	4.48	0.63	93.5
16	To understand wildlife harvest management concepts and implications when developing management plans.	Biological Sciences	5	4.48	0.72	93.5
17	To be knowledgeable in forest ecology and management.	Biological Sciences	5	4.45	0.68	90.3
18	The ability to utilize man-made practices as useful ecological management tools (grazing, prescribed fire, herbicide application, logging, agronomic practices, etc).	Biological Sciences	5	4.42	0.76	90.3
19	The ability to implement and assess habitat management techniques on target and non-target species habitat.	Biological Sciences	5	4.39	0.72	87.1
20	The ability to determine and identify species-specific habitat requirements.	Biological Sciences	4	4.35	0.61	100
21	The ability to determine and identify species specific limiting factors.	Biological Sciences	4	4.35	0.71	100
22	To be familiar with localized endangered and threatened species.	Biological Sciences	5	4.35	0.84	90.3
23	To have a working understanding of population dynamic principles.	Biological Sciences	4	4.29	0.69	100
24	To have well grounded training in the conservation and protection of biodiversity in management planning	Biological Sciences	5	4.29	1.04	100
25	The ability to recognize variables and relationships within an	Biological Sciences	4	4.23	0.76	100

(Table cont.)

	ecosystem (plant-animal-environment).					
26	To have a sound foundation in botany.	Biological Sciences	4	4.23	0.76	100
27	To have knowledge of techniques for estimating animal density and diversity.	Biological Sciences	4	4.19	0.65	100
28	The ability to locate species specific plant life history and determine plant species value to wildlife.	Biological Sciences	4	4.19	0.70	100
29	The ability to apply ecological concepts and models to problems in natural resource and ecosystem management.	Biological Sciences	4	4.19	0.83	100
30	The ability to identify and utilize specific state-of-the-art wildlife management methods and techniques for high profile non-game species.	Biological Sciences	4	4.16	0.69	100
31	The ability to identify and utilize state-of-the-art wildlife management techniques for major game species.	Biological Sciences	4	4.16	0.82	96.7
32	To have the basic understanding of landscape ecology for ecosystem restoration and management planning.	Biological Sciences	4	4.16	0.90	96.7
33	To have knowledge of all basic wildlife courses.	Biological Sciences	4	4.16	0.97	96.7
34	To have a working knowledge for ageing, sexing, trapping, capturing, handling, marking, and radio telemetry tracking of wildlife.	Biological Sciences	4	4.10	0.87	100
35	The ability to visually and auditorially identify wildlife.	Biological Sciences	4	4.06	0.73	100
36	To have basic knowledge of ornithology.	Biological Sciences	4	4.03	0.71	100
37	The ability to merge the management principles of upland, wetland, and aquatic systems to meet wildlife management and	Biological Sciences	4	4.03	0.80	100

(Table cont.)

	biodiversity objectives.					
38	The ability to implement forest management and silvicultural practices for wildlife habitat restoration, maintenance, and management.	Biological Sciences	4	4.03	0.84	100
39	The ability to identify the current successional stage of a plant community and predict the wildlife inhabitants.	Biological Sciences	4	4.03	0.84	96.7
40	The ability to identify the successional stage of a plant community.	Biological Sciences	4	4.03	0.91	93.5
41	To understand the importance of indicator species habitat requirements when preparing and implementing management strategies.	Biological Sciences	4	4.00	0.82	100
42	To have a sound foundation of zoology.	Biological Sciences	4	4.00	0.86	96.7
43	To have basic knowledge of mammology.	Biological Sciences	4	3.97	0.71	100
44	To have the basic understanding of wildland fire ecology.	Biological Sciences	4	3.97	0.84	100
45	The ability to identify mammals, birds, reptiles, amphibians, and fish to species; insects to order; other invertebrates to phyla and order through the use of a key.	Biological Sciences	4	3.97	0.91	96.7
46	The ability to sex wildlife.	Biological Sciences	4	3.97	1.02	93.5
47	To have knowledge of techniques for estimating plant density and diversity.	Biological Sciences	4	3.94	0.68	100
48	The ability to identify wildlife habitat use by wildlife sign.	Biological Sciences	4	3.94	0.77	100
49	The ability to develop, implement, and manage an adaptive resource habitat management plan.	Biological Sciences	4	3.90	0.79	100
50	The ability to implement adaptive resource management to evaluate habitat response and future management options.	Biological Sciences	4	3.87	0.81	100

(Table cont.)

51	To have knowledge of the factors affecting wildlife growth, reproduction, fitness, and survival including knowledge of diseases and genetics.	Biological Sciences	4	3.84	0.69	100
52	The ability to determine and identify species-specific predator/prey relationships.	Biological Sciences	4	3.84	0.78	96.7
53	The ability to handle wildlife.	Biological Sciences	4	3.84	0.82	96.7
54	The ability to key-out an avian species.	Biological Sciences	4	3.84	0.90	96.7
55	To have knowledge of waterfowl management techniques.	Biological Sciences	4	3.84	0.90	96.7
56	To have knowledge of forest management techniques that pertain to forest dwelling migratory birds.	Biological Sciences	4	3.81	0.75	100
57	The ability to identify, sex, and age waterfowl.	Biological Sciences	4	3.77	0.80	100
58	To have basic knowledge and skills of dendrology (keying, collecting, preserving, and ageing plants).	Biological Sciences	4	3.77	0.80	96.7
59	The ability to identify wetland plant species and community composition to determine the wetland ecosystem type.	Biological Sciences	4	3.74	0.68	100
60	The ability to key-out regional and national plant species.	Biological Sciences	4	3.74	0.73	100
61	The ability to use current methods of plant eradication to control invasive exotic species for habitat restoration and management.	Biological Sciences	4	3.74	0.89	93.5
62	To have knowledge of the life history requirements for various migratory birds.	Biological Sciences	4	3.68	0.65	100
63	The ability to implement and assess prescribed fire for habitat restoration and management.	Biological Sciences	4	3.68	0.70	100

(Table cont.)

64	The ability to trap wildlife.	Biological Sciences	4	3.65	0.80	96.7
65	To be knowledgeable of white-tailed deer management techniques.	Biological Sciences	4	3.58	0.76	93.5
66	The ability to key-out vertebrate species.	Biological Sciences	3	3.58	0.76	87.1
67	The ability to identify, classify, and compare plant communities by implementing plant surveying and mapping techniques (e.g. Daubenmire habitat method).	Biological Sciences	4	3.55	0.57	100
68	To have knowledge of forest management with emphasis on hardwood management.	Biological Sciences	3	3.55	0.72	90.3
69	To have knowledge of the life history requirements for waterfowl.	Biological Sciences	4	3.55	0.77	93.5
70	The ability to implement water level management strategies for habitat restoration and management.	Biological Sciences	3	3.42	0.89	90.3
71	To have knowledge of coniferous ecosystems.	Biological Sciences	3	3.39	0.72	96.7
72	The ability to key-out a mammal species.	Biological Sciences	3	3.39	0.88	90.3
73	The ability to identify, sex, and age neotropical birds.	Biological Sciences	3	3.32	0.70	96.7
74	To have knowledge of wildlife damage management principles.	Biological Sciences	3	3.32	0.98	90.3
75	To have knowledge of the factors affecting plant growth, reproduction, fitness, and survival including knowledge of diseases and genetics.	Biological Sciences	3	3.29	0.69	100
76	The ability to implement survey techniques for migratory neotropical birds.	Biological Sciences	3	3.26	0.63	100
77	To have an understanding of range ecology and management principles.	Biological Sciences	3	3.26	0.89	90.3
78	The ability to age various wildlife species by locating and	Biological Sciences	3	3.23	0.72	100

(Table cont.)

	implementing species-specific techniques.					
79	To have basic knowledge of mammalian reproductive physiology.	Biological Sciences	3	3.23	0.80	100
80	The ability to identify animal sign for animal damage control assessment.	Biological Sciences	3	3.23	0.88	96.7
81	To have basic knowledge of avian reproductive physiology.	Biological Sciences	3	3.23	0.92	93.5
82	To have a basic knowledge of herpetology.	Biological Sciences	3	3.19	0.48	100
83	To have knowledge of fish biology and management.	Biological Sciences	3	3.19	0.87	93.5
84	The ability to implement survey techniques for members of the Cervidae family.	Biological Sciences	3	3.16	0.86	96.7
85	The ability to implement waterfowl surveys.	Biological Sciences	3	3.16	0.90	96.7
86	To have basic knowledge of mammalian anatomy.	Biological Sciences	3	3.10	0.75	96.7
87	The ability to manage greentree and moist soil units for target species and species diversity.	Biological Sciences	3	3.10	0.98	90.3
88	To have knowledge of the effects of disease on wildlife growth, reproduction, fitness, and survival.	Biological Sciences	3	3.06	0.68	100
89	To understand the basic principles of plant physiology.	Biological Sciences	3	3.06	0.77	96.7
90	The ability to age deer by dental wear.	Biological Sciences	3	3.06	0.96	93.5
91	To have knowledge of shorebird life history.	Biological Sciences	3	3.03	0.84	100
92	To have knowledge of shorebird management techniques.	Biological Sciences	3	3.00	0.93	96.7
93	To have basic knowledge of avian anatomy.	Biological Sciences	3	2.97	0.71	96.7
94	To have knowledge of the effects of genetics on wildlife growth, reproduction, fitness, and survival.	Biological Sciences	3	2.94	0.63	100
95	The ability to determine and identify species-specific	Biological Sciences	3	2.94	0.85	93.5

(Table cont.)

	agricultural depredation potentials.					
96	The ability to key-out invertebrate species.	Biological Sciences	3	2.90	0.98	93.5
97	The ability to implement survey techniques for shorebirds.	Biological Sciences	3	2.87	0.85	100
98	To have basic knowledge of mammalian physiology.	Biological Sciences	3	2.84	0.64	100
99	To have an understanding of modern genetic approaches in wildlife conservation.	Biological Sciences	3	2.81	0.60	100
100	The ability to identify signs and symptoms of common wildlife diseases.	Biological Sciences	3	2.81	0.79	100
101	To have basic knowledge of the taxonomy of spermatophytes.	Biological Sciences	3	2.81	0.91	96.7
102	To have basic knowledge of avian physiology.	Biological Sciences	3	2.77	0.62	100
103	To have a basic knowledge of entomology with emphasis in aquatic insects and tree damaging pathogens.	Biological Sciences	3	2.71	0.59	100
104	The ability to perform basic necropsy procedures and protocol, which include sample collection and tissue storage.	Biological Sciences	3	2.65	0.80	93.5
105	The ability to administer proper animal care through animal husbandry techniques and contemporary knowledge of animal welfare issues.	Biological Sciences	2	2.65	1.08	87.1
106	To have knowledge of agrostology for the study of grasses and grassland habitat management.	Biological Sciences	2	2.45	0.57	100
107	To have knowledge of animal evolution, which includes ecological, genetic and molecular techniques.	Biological Sciences	2	2.32	0.83	93.5
108	To have knowledge of plant evolution, which includes ecological, genetic and molecular techniques.	Biological Sciences	2	2.16	0.73	100

(Table cont.)

Note. Mean ratings were classified according to the following interpretive scale: 5.00 – 4.50 = high importance; 4.49 – 3.50 = substantial importance; 3.49 – 2.50 = moderate importance; 2.49 – 1.50 = low importance; and 1.49 – 1.00 = no importance.
[a]Job skill area = curriculum content area as defined by The Wildlife Society (TWS) plus practical daily work skills.
[b]Median of ratings assigned by Delphi Panelists.
[c]Mean rating based on following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.
[d]Level of consensus = percentage of responding panelists within $\pm$ 1 of the median.

Round Three Physical Sciences Entry-Level Job Skill Ratings.--Thirty-five physical science job skill items were rated by the Delphi panel using the following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance (Table 18). The items were then ranked by mean and classified using the following interpretive scale: 5.00 – 4.50 = "high importance"; 4.49 – 3.50 = "substantial importance"; 3.49 – 2.50 = "moderate importance"; 2.49 – 1.50 = "low importance"; and 1.49 – 1.00 = "no importance."

The highest rated item "The ability to use plant community indices to determine wildlife habitat value" had a mean of 4.23 (SD = 0.67) and a 100% level of consensus. The lowest rated item "The ability to assess and implement irrigation techniques for land use" had a mean of 2.26 (SD = 0.93) and a 90.3% level of consensus. Overall, no items were rated as "high importance" (5.00 – 4.50); eight items were rated as "substantial importance" (4.49 – 3.50); 24 items were rated as "moderate importance" (3.49 – 2.50); three items were rated as "low importance" (2.49 – 1.50); and no items were rated as "no importance" (1.49 – 1.00).

Table 18. Importance of Physical Sciences Entry-Level Job Skills Needed by Wildlife Management Professionals as Perceived by Wildlife Management Experts in a Round Three Delphi Survey.

Rank	Item	Job Skill Area[a]	Med[b]	X[c]	SD	%[d]
1	The ability to use plant community indices to determine wildlife habitat value.	Physical Sciences	4	4.23	0.67	100

(Table cont.)

2	To have a basic knowledge of hydrology.	Physical Sciences	4	3.94	0.81	96.7
3	To understand the relationship between abiotic factors (climate, hydrology, soils) and biotic productivity and diversity.	Physical Sciences	4	3.9	0.79	100
4	The ability to use contemporary soil erosion control techniques within the wildlife management area.	Physical Sciences	4	3.77	0.76	100
5	The ability to implement and assess appropriate aquatic habitat management techniques.	Physical Sciences	4	3.77	0.76	100
6	To have basic knowledge of agronomy (soil characteristics, identification, and productivity).	Physical Sciences	4	3.74	0.77	100
7	The ability to identify non-wetland and wetland soil types by soil characteristics, soil maps, and imagery.	Physical Sciences	4	3.71	0.82	96.7
8	To recognize and understand the relationship between climate and ecosystems.	Physical Sciences	4	3.58	0.81	93.5
9	To understand the relationship between soil type, soil fertility, soil hydrology, and plant community to assess ecosystem cycling, productivity, and distribution.	Physical Sciences	3	3.48	0.81	90.3
10	To understand and recognize the relationships between geology and ecosystems of the work area, district and region.	Physical Sciences	3	3.35	0.84	90.3
11	To understand the relationships between geography and ecosystems.	Physical Sciences	3	3.35	0.88	90.3
12	To have knowledge of basic water quality monitoring techniques.	Physical Sciences	3	3.23	0.8	93.5
13	The ability to use soil type and topography to assess the hydrologic regime.	Physical Sciences	3	3.23	0.84	96.7
14	To recognize and understand the relationship between regionalized weather patterns (daily, seasonal,	Physical Sciences	3	3.23	0.84	96.7

(Table cont.)

	and long-term patterns) and weather impacts on wildlife.					
15	The ability to implement and manage moist soil unit plant productivity.	Physical Sciences	3	3.23	0.99	87.1
16	The ability to manage the soil for improved environmental and economic productivity.	Physical Sciences	3	3.16	0.69	96.7
17	To recognize and understand the relationship between elevation and ecosystem diversity.	Physical Sciences	3	3.16	0.86	96.7
18	To have a practical understanding of meteorology.	Physical Sciences	3	3.16	0.93	93.5
19	The ability to effectively manage prescribed fire to protect air quality.	Physical Sciences	3	3.13	0.81	96.7
20	The ability to use surface soils, sub-surface soils, and topography information to assess surface water retention, ground water components, and hydrologic cycles for wildlife management planning.	Physical Sciences	3	3.10	0.79	96.7
21	The ability to map and inventory a watershed.	Physical Sciences	3	3.10	0.87	90.3
22	The ability to identify, locate, implement, and assess site-specific controls for non-point source pollution to improve water quality.	Physical Sciences	3	3.06	0.96	90.3
23	The ability to apply wildfire risk assessment models to "species at risk."	Physical Sciences	3	2.94	0.81	100
24	The ability to understand a soil analysis and determine fertilizer and lime recommendations.	Physical Sciences	3	2.94	0.85	96.7
25	The ability to identify, locate, implement, and assess site-specific controls for non-point source pollution to improve water quality.	Physical Sciences	3	2.94	0.93	90.3
26	To have knowledge of water chemistry and water quality sampling methods.	Physical Sciences	3	2.90	0.83	96.7
26	To have knowledge of water chemistry and water quality sampling methods.	Physical Sciences	3	2.90	0.83	96.7

(Table cont.)

27	To have a basic knowledge of physical and organic chemistry to aid with chemical applications (fertilizer, herbicides, and pesticides).	Physical Sciences	3	2.84	0.78	100
28	To have the basic knowledge of organic chemistry.	Physical Sciences	3	2.84	0.86	93.5
29	The ability to determine the suitability of land for agronomic production.	Physical Sciences	3	2.81	0.83	100
30	To have the basic knowledge of inorganic chemistry.	Physical Sciences	3	2.74	0.89	93.5
31	The ability to monitor water quality using direct and remote automated equipment for wildlife management planning.	Physical Sciences	3	2.61	0.92	87.1
32	The ability to use basic meteorological monitoring equipment and apply meteorological data for wildlife management planning.	Physical Sciences	2	2.52	0.85	90.3
33	To have knowledge of organic and biochemistry with specific information on toxicology and environmental health.	Physical Sciences	2	2.45	0.72	93.5
34	The ability to monitor and interpret basic soil and water models to estimate sediment yield, water quality, and water heating.	Physical Sciences	2	2.35	0.84	93.5
35	The ability to assess and implement irrigation techniques for land use.	Physical Sciences	2	2.26	0.93	90.3

Note. Mean ratings were classified according to the following interpretive scale: 5.00 – 4.50 = high importance; 4.49 – 3.50 = substantial importance; 3.49 – 2.50 = moderate importance; 2.49 – 1.50 = low importance; and 1.49 – 1.00 = no importance.
[a]Job skill area = curriculum content area as defined by The Wildlife Society (TWS) plus practical daily work skills.
[b]Median of ratings assigned by Delphi Panelists.
[c]Mean rating based on following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.
[d]Level of consensus = percentage of responding panelists within $\pm$ 1 of the median.

Round Three Basic Statistics Entry-Level Job Skill Ratings.--Twenty-seven basic statistic job skill items were rated by the Delphi panel using the following anchored scale: 5 =

high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance (Table 19). The items were then ranked by mean and classified using the following interpretive scale: 5.00 – 4.50 = "high importance"; 4.49 – 3.50 = "substantial importance"; 3.49 – 2.50 = "moderate importance"; 2.49 – 1.50 = "low importance"; and 1.49 – 1.00 = "no importance."

The highest rated item "To understand the application of statistics to wildlife management and research" had a mean of 4.71 (SD = 0.46) and a 100% level of consensus. The lowest rated item "The ability to use inferential statistics to estimate home range" had a mean of 2.58 (SD = 0.81) and a 90.3% level of consensus. Overall five items were rated as "high importance" (5.00 – 4.50); 17 items were rated as "substantial importance" (4.49 – 3.50); five items were rated as "moderate importance" (3.49 – 2.50); no items were rated as "low importance" (2.49 – 1.50); and no items were rated as no importance (1.49 – 1.00).

Table 19. Importance of Basic Statistics Entry-Level Job Skills Needed by Wildlife Management Professionals as Perceived by Wildlife Management Experts in a Round Three Delphi Survey.

Rank	Item	Job Skill Area[a]	Med[b]	X[c]	SD	%[d]
1	To understand the application of statistics to wildlife management and research.	Basic Statistics	5	4.71	0.46	100
2	The ability to read and interpret scientific articles to understand the study results.	Basic Statistics	5	4.71	0.53	96.7
3	To have knowledge of sampling principles for assessing wildlife populations and wildlife habitat.	Basic Statistics	5	4.58	0.5	100
4	To understand the value of scientific survey sampling in wildlife management.	Basic Statistics	5	4.55	0.57	96.7
5	To have a basic understanding of statistical methods to estimate wildlife populations.	Basic Statistics	5	4.52	0.63	93.5

(Table cont.)

6	The ability to recognize a statistically valid sample versus some "neat information."	Basic Statistics	5	4.48	0.57	96.7
6	The ability to recognize a statistically valid sample versus some "neat information."	Basic Statistics	5	4.48	0.57	96.7
7	The ability to conduct simple analysis with guidance from a scientist or biometrician.	Basic Statistics	5	4.42	0.81	96.7
8	The ability to understand basic (inferential) statistical concepts.	Basic Statistics	4	4.35	0.84	96.7
9	The ability to apply the concepts of accuracy, precision and the scientific method for hypothesis testing.	Basic Statistics	4	4.26	0.73	100
10	To understand the effect of sample size on research findings and management outcomes.	Basic Statistics	4	4.26	0.77	100
11	To understand the basic variables and relationships of wildlife population dynamics.	Basic Statistics	4	4.19	0.75	100
12	The ability to perform routine analysis of raw data using descriptive statistics.	Basic Statistics	4	4.13	0.92	96.7
13	The ability to use descriptive statistics in the biometric analysis of wildlife phenomenon.	Basic Statistics	4	4.06	0.89	96.7
14	To have experience in statistical procedure and data analysis.	Basic Statistics	4	3.94	0.93	96.7
15	The ability to use statistics to plan, implement, and assess science-based wildlife management programs (adaptive resource management).	Basic Statistics	4	3.90	0.70	100
16	The ability to design a sampling survey and analyze the survey data to estimate and monitor population trends.	Basic Statistics	4	3.81	0.83	100
17	The ability to determine the appropriate sample size for wildlife research and adaptive resource management.	Basic Statistics	4	3.74	0.82	96.7

(Table cont.)

18	The ability to use descriptive statistics to conduct habitat analysis and predict future habitat changes	Basic Statistics	4	3.74	0.86	96.7
19	The ability to use scientific journal writings to develop a theoretical approach to problem solving.	Basic Statistics	4	3.74	0.86	96.7
20	The ability to use statistical software packages to record and evaluate data.	Basic Statistics	4	3.74	1.00	93.5
21	The ability to implement population-adaptive harvest management techniques.	Basic Statistics	4	3.58	0.89	90.3
22	The ability to understand the assumptions of parametric and non-parametric statistics.	Basic Statistics	3	3.52	0.68	93.5
23	The ability to statistically analyze population data to determine population growth and recruitment potential.	Basic Statistics	3	3.39	0.76	93.5
24	To be able to read and understand reports that utilize advanced statistical concepts (ANCOVA, Logistic Regression, etc.).	Basic Statistics	3	3.10	0.94	90.3
25	To be able to read and understand complex research designs.	Basic Statistics	3	2.90	0.87	96.7
26	To be familiar with SAS (Statistical Analysis System).	Basic Statistics	3	2.81	0.75	96.7
27	The ability to use inferential statistics to estimate home range.	Basic Statistics	2	2.58	0.81	90.3

Note. Mean ratings were classified according to the following interpretive scale: 5.00 – 4.50 = high importance; 4.49 – 3.50 = substantial importance; 3.49 – 2.50 = moderate importance; 2.49 – 1.50 = low importance; and 1.49 – 1.00 = no importance.
[a]Job skill area = curriculum content area as defined by The Wildlife Society (TWS) plus practical daily work skills.
[b]Median of ratings assigned by Delphi Panelists.
[c]Mean rating based on following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.
[d]Level of consensus = percentage of responding panelists within ± 1 of the median.

Round Three Quantitative Sciences Entry-Level Job Skill Ratings.--Forty-nine quantitative sciences job skill items were rated by the Delphi panel using the following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance (Table 20). The items were then ranked by mean and classified using the following interpretive scale: 5.00 – 4.50 = "high importance"; 4.49 – 3.50 = "substantial importance"; 3.49 – 2.50 = "moderate importance"; 2.49 – 1.50 = "low importance"; and 1.49 – 1.00 = "no importance".

The highest rated item "The ability to accurately measure and record data" had a mean of 4.90 (SD = 0.30) and a 100% level of consensus. The lowest rated item "The ability to implement variable-plot tree cruising using a Relaskop instrument" had a mean of 2.29 (SD = 0.74) and a 100 % level of consensus. Overall, four items were rated as "high importance" (5.00 – 4.50); 18 items were rated as "substantial importance" (4.49 – 3.50); 26 items were rated as "moderate importance" (3.49 – 2.50); one item was rated as "low importance" (2.49 – 1.50); and no items were rated as "no importance" (1.49 – 1.00).

Table 20. Importance of Quantitative Sciences Entry-Level Job Skills Needed by Wildlife Management Professionals as Perceived by Wildlife Management Experts in a Round Three Delphi Survey.

Rank	Item	Job Skill Area[a]	Med[b]	X[c]	SD	%[d]
1	The ability to accurately measure and record data.	Quantitative Sciences	5	4.90	0.30	100
2	To be familiar with general wildlife sampling methods.	Quantitative Sciences	5	4.81	0.40	100
3	To have basic computational skills.	Quantitative Sciences	5	4.65	0.55	96.7
4	To understand the difference between inventorying (what's there), monitoring (what's it doing), and research (why's it doing that).	Quantitative Sciences	5	4.58	0.56	96.7
5	To have a broad understanding of vegetative sampling techniques commonly used in modern land management activities.	Quantitative Sciences	4	4.45	0.57	100
6	The ability to develop, implement, and complete comprehensive	Quantitative Sciences	4	4.35	0.71	100

(Table cont.)

	wildlife management plans for individual species and groups of species.					
7	The ability to use GIS, GPS, aerial photography, cartography, and map reading for natural resource management planning, monitoring, and assessment.	Quantitative Sciences	4	4.29	0.69	100
8	The ability to organize survey sampling and monitoring techniques for plants to evaluate wildlife habitat (e.g. imagery; sampling methods - transects (random, stratified, cluster), data (plots, plotless, point intercept).	Quantitative Sciences	4	4.23	0.56	100
9	The ability to organize survey sampling and monitoring techniques for wildlife (mammals, birds, reptiles, amphibians, fish, and invertebrates) (e.g. capture, marking, radio telemetry, sexing, ageing).	Quantitative Sciences	4	4.23	0.67	100
10	The ability to design, implement, and interpret field surveys.	Quantitative Sciences	4	4.19	0.75	100
11	To have knowledge of the urban/wildland interface.	Quantitative Sciences	4	4.16	0.86	100
12	To have the basic knowledge and familiarity with modern surface mapping and remote sensing techniques to include computer usage, GIS, GPS, aerial photography, satellite imagery, and cartography to model, monitor, and assess natural resources.	Quantitative Sciences	4	4.13	0.76	100
13	To have knowledge of the agriculture/wildland interface.	Quantitative Sciences	4	4.13	0.92	100
14	To develop critical quantitative thinking skills by completing math courses through college algebra.	Quantitative Sciences	4	3.97	0.84	100
15	To be introduced to modeling as a wildlife management tool.	Quantitative Sciences	4	3.84	0.69	100
16	The ability to estimate and identify surface features through aerial	Quantitative Sciences	4	3.77	0.8	96.7

(Table cont.)

	photograph interpretation.					
17	The ability to apply population models as wildlife management tools (population estimates, indices, life tables and projection, survival, band return, capture-recapture models, sightability models, and minimum viable population analysis).	Quantitative Sciences	4	3.74	0.73	100
18	The ability to implement and complete biodiversity assessments.	Quantitative Sciences	4	3.68	0.75	96.7
19	To develop critical quantitative thinking skills by completing math courses through college calculus.	Quantitative Sciences	4	3.68	0.87	93.5
20	To develop critical quantitative thinking skills by completing math courses through college trigonometry.	Quantitative Sciences	4	3.68	0.94	96.7
21	To have knowledge of spatial and temporal landscape analysis.	Quantitative Sciences	4	3.65	0.88	93.5
22	The ability to identify the pertinent factors which affect a transect sampling route.	Quantitative Sciences	4	3.61	0.76	96.7
23	The ability to estimate animal populations by ground transects.	Quantitative Sciences	3	3.42	0.76	93.5
24	The ability to identify all plants and plant communities within a sampling point.	Quantitative Sciences	3	3.39	0.62	100
25	The ability to use timber inventory sampling techniques that are commonly used in modern forest management.	Quantitative Sciences	3	3.39	0.80	93.5
26	The ability to plan, implement, and assess the findings of random transect sampling.	Quantitative Sciences	3	3.35	0.71	93.5
27	The ability implement risk assessments for "species at risk."	Quantitative Sciences	3	3.32	0.60	96.7
28	The ability to plan, implement, and assess the findings of a point-center plot survey.	Quantitative Sciences	3	3.32	0.70	96.7
29	The ability to plan, implement, and assess the findings of a plot transect survey.	Quantitative Sciences	3	3.32	0.70	96.7

(Table cont.)

30	The ability to plan, implement, and assess a belt-line transect sampling design.	Quantitative Sciences	3	3.29	0.69	96.7
31	The ability to conduct waterfowl surveys utilizing current technology.	Quantitative Sciences	3	3.29	0.69	96.7
32	The ability to use, develop, or adapt habitat suitability index models to estimate habitat quality and potential.	Quantitative Sciences	3	3.29	0.78	96.7
33	To be familiar with various radio telemetry techniques.	Quantitative Sciences	3	3.29	0.86	93.5
34	The ability to conduct deer surveys using current technology.	Quantitative Sciences	3	3.26	0.82	93.5
35	The ability to estimate animal populations by aerial transects.	Quantitative Sciences	3	3.23	0.80	93.5
36	The ability to plan, implement, and assess the findings of a browse survey.	Quantitative Sciences	3	3.23	0.84	96.7
37	The ability to plan, implement, and assess the findings of a public opinion survey (questionnaires).	Quantitative Sciences	3	3.16	0.82	100
38	The ability to identify soil types and characteristics within a sampling point.	Quantitative Sciences	3	3.13	0.76	96.7
39	To have knowledge of grassland/rangeland inventory techniques.	Quantitative Sciences	3	3.10	0.83	96.7
40	To have knowledge of silvicultural biometrics.	Quantitative Sciences	3	3.00	0.82	96.7
41	The ability to conduct shorebird surveys using current technology.	Quantitative Sciences	3	2.97	0.80	100
42	The ability to apply classification and ordination statistics to determine ecological groupings and gradients.	Quantitative Sciences	3	2.97	0.87	93.5
43	The ability to use basic land surveying techniques (e.g. shooting elevations, determining boundaries, setting grade, road construction, logging systems).	Quantitative Sciences	3	2.94	1.06	90.3
44	To develop critical quantitative thinking skills by completing	Quantitative Sciences	3	2.87	0.92	96.7

(Table cont.)

	College physics					
45	The ability to implement a species-specific population viability analysis.	Quantitative Sciences	3	2.84	0.82	96.7
46	The ability to conduct mourning dove surveys using current technology.	Quantitative Sciences	3	2.71	0.86	93.5
47	The ability to conduct woodcock surveys using current technology.	Quantitative Sciences	3	2.65	0.84	93.5
48	The ability to conduct rail surveys using current technology.	Quantitative Sciences	3	2.65	0.84	93.5
49	The ability to implement variable-plot tree cruising using a Relaskop instrument.	Quantitative Sciences	2	2.29	0.74	100

Note. Mean ratings were classified according to the following interpretive scale: 5.00 – 4.50 = high importance; 4.49 – 3.50 = substantial importance; 3.49 – 2.50 = moderate importance; 2.49 – 1.50 = low importance; and 1.49 – 1.00 = no importance.
[a]Job skill area = curriculum content area as defined by The Wildlife Society (TWS) plus practical daily work skills.
[b]Median of ratings assigned by Delphi Panelists.
[c]Mean rating based on following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.
[d]Level of consensus = percentage of responding panelists within $\pm$ 1 of the median.

Round Three Humanities Entry-Level Job Skill Ratings.--Thirty-two humanities job skill items were rated by the Delphi panel using the following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance (Table 21). The items were then ranked by mean and classified using the following interpretive scale: 5.00 – 4.50 = “high importance”; 4.49 – 3.50 = “substantial importance”; 3.49 – 2.50 = “moderate importance”; 2.49 – 1.50 = “low importance”; and 1.49 – 1.00 = “no importance”.

The highest rated item “The ability to develop personal environmental ethics and a resource philosophy” had a mean of 4.81 (SD = 0.40) and a 100% level of consensus. The lowest rated item “The ability to apply macro and microeconomics concepts to wildlife management” had a mean of 2.26 (SD = 0.58) and a 100 % level of consensus. Overall, seven items were rated as “high importance” (5.00 – 4.50); 20 items were rated as “substantial importance” (4.49 – 3.50); five items were rated as “moderate importance” (3.49 – 2.50), no items were rated as “low importance” (2.49 – 1.50); and no items were rated as “no importance” (1.49 – 1.00).

Table 21. Importance of Humanities Entry-Level Job Skills Needed by Wildlife Management Professionals as Perceived by Wildlife Management Experts in a Round Three Delphi Survey.

Rank	Item	Job Skill Area[a]	Med[b]	X[c]	SD	%[d]
1	The ability to develop personal environmental ethics and a resource philosophy.	Humanities	5	4.81	0.40	100
2	The ability to locate and retrieve reliable wildlife information from the library and internet resources.	Humanities	5	4.74	0.44	100
3	The ability to develop and maintain partnerships in wildlife management.	Humanities	5	4.74	0.51	96.7
4	The ability to function as a well-rounded member of society.	Humanities	5	4.68	0.48	100
5	The ability to understand private landowner needs and their relationship to wildlife and land management.	Humanities	5	4.68	0.48	100
6	To have a foundation of wildlife conservation and land management history.	Humanities	5	4.61	0.50	100
7	The ability to work professionally in order to be accepted as professionals by future society.	Humanities	5	4.61	0.62	93.5
8	The ability to recognize the history, role, and importance of consumptive wildlife use (hunting, fishing, and trapping) as a wildlife conservation/management tool.	Humanities	5	4.48	0.68	90.3
9	The ability to recognize the history, role, and importance of consumptive wildlife use (hunting, fishing, and trapping) as a wildlife conservation/management tool.	Humanities	5	4.48	0.68	90.3

(Table cont.)

10	The ability to understand public perception of wildlife and associated habitats.	Humanities	4	4.26	0.77	100
11	The ability to understand the need for social acceptance of consumptive natural resource use (hunting, trapping, and fishing).	Humanities	4	4.23	0.80	96.7
12	To have an understanding of conservation biology	Humanities	4	4.16	0.90	96.7
13	The ability to recognize the social implications of wildlife management actions and pre-planning responses to questions and challenges made by those who do not understand or support hunting as a wildlife management tool.	Humanities	4	4.10	0.83	96.7
14	The ability to recognize, understand, and appreciate diverse cultural perspectives regarding wildlife values (stakeholder diversity).	Humanities	4	4.06	0.85	100
15	The ability to recognize how diverse social values affect wildlife management decisions.	Humanities	4	4.03	0.80	100
16	The ability to understand that changing U.S. demographics will impact future wildlife management.	Humanities	4	4.03	0.91	96.7
17	The ability to recognize human need for outdoor recreation and to understand the apparent implications if that need is denied or suppressed (conflict management).	Humanities	4	4.00	0.82	100
18	The ability to recognize and understand diverse cultural natural resource values.	Humanities	4	4.00	0.82	100
19	The ability to recognize the value of human diversity in the workplace.	Humanities	4	4.00	0.86	100
20	The ability to relate wildlife or habitat trends to human dynamics.	Humanities	4	3.97	0.84	100
21	To understand and appreciate diverse human cultures and	Humanities	4	3.97	0.87	100

(Table cont.)

	associated wildlife value systems.					
22	To recognize the impact of giving animals human traits by TV and other media, which will affect society's acceptance of consumptive wildlife use (hunting and trapping).	Humanities	4	3.97	0.98	90.3
23	To have knowledge of political and social history at the local, state, and national level, which involve wildlife management.	Humanities	4	3.90	0.75	100
24	The ability to understand "anti-group stakeholders" (e.g. PETA) and their perspectives.	Humanities	4	3.90	0.83	96.7
25	The ability to apply real world economics and capitalism in wildlife management.	Humanities	4	3.84	0.86	100
26	The ability to understand historical and contemporary roles of society in wildlife management.	Humanities	4	3.81	0.75	100
27	The ability to understand and apply human social, demographic, economic, and political implications as related to wildlife law, sustainable resources, management, harvest, conservation, preservation, and assessment.	Humanities	3	3.52	0.77	90.3
28	To be familiar with global historic and contemporary wildlife issues.	Humanities	3	3.48	0.51	100
29	The ability to understand diverse wildlife values and use that information to design and implement environmental education and/or outreach programs.	Humanities	3	3.39	0.80	90.3
30	To have knowledge of political science.	Humanities	3	3.35	0.84	90.3
31	The ability to understand historical and contemporary roles of society in forest management.	Humanities	3	3.32	0.75	96.7
32	The ability to apply macro and microeconomics concepts to wildlife management.	Humanities	3	3.26	0.58	100

(Table cont.)

Note. Mean ratings were classified according to the following interpretive scale: 5.00 – 4.50 = high importance; 4.49 – 3.50 = substantial importance; 3.49 – 2.50 = moderate importance; 2.49 – 1.50 = low importance; and 1.49 – 1.00 = no importance.
[a]Job skill area = curriculum content area as defined by The Wildlife Society (TWS) plus practical daily work skills.
[b]Median of ratings assigned by Delphi Panelists.
[c]Mean rating based on following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.
[d]Level of consensus = percentage of responding panelists within $\pm$ 1 of the median.

Round Three Communications Entry-Level Job Skill Ratings.--Thirty-two communications job skill items were rated by the Delphi panel using the following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance (Table 22). The items were then ranked by mean and classified using the following interpretive scale: 5.00 – 4.50 = "high importance"; 4.49 – 3.50 = "substantial importance"; 3.49 – 2.50 = "moderate importance"; 2.49 – 1.50 = "low importance"; and 1.49 – 1.00 = "no importance".

The highest rated item "The ability to write a simple technical report" had a mean of 4.90 (SD = 0.30) and a 100% level of consensus. The lowest rated item "The ability to write grants" had a mean of 2.87 (SD = 0.72) and a 100 % level of consensus. Overall, 17 items were rated as "high importance" (5.00 – 4.50); 15 items were rated as "substantial importance" (4.49 – 3.50); two items were rated as "moderate importance" (3.49 – 2.50), no items were rated as "low importance" (2.49 – 1.50), and no items were rated as "no importance" (1.49 – 1.00).

Table 22. Importance of Communication Entry-Level Job Skills Needed by Wildlife Management Professionals as Perceived by Wildlife Management Experts in a Round Three Delphi Survey.

Rank	Item	Job Skill Area[a]	Med[b]	X[c]	SD	%[d]
1	The ability to write a simple technical report.	Communications	5	4.90	0.30	100
2	The ability to write plans, reports, technical papers, and other	Communications	5	4.90	0.30	100

(Table cont.)

	documents using good grammar, punctuation, and techniques.					
3	The ability to skillfully communicate with diverse groups and individuals.	Communica tions	5	4.87	0.34	100
4	The ability to professionally and effectively communicate one-on-one at any level of understanding (technical and lay person).	Communica tions	5	4.84	0.37	100
5	The ability to keep a positive, friendly, and outgoing attitude.	Communica tions	5	4.84	0.37	100
6	The ability to develop and maintain interpersonal relationships.	Communica tions	5	4.81	0.40	100
7	The ability to be a team player and recognize the role of effective teamwork in organizations.	Communica tions	5	4.81	0.40	100
8	The ability to lead and follow as the situation warrants.	Communica tions	5	4.77	0.43	100
9	The ability to professionally present information to a group of peers.	Communica tions	5	4.71	0.46	100
10	The ability to write effectively for various audiences.	Communica tions	5	4.71	0.46	100
11	The ability to communicate through written professional correspondence.	Communica tions	5	4.71	0.46	100
12	The ability to communicate through good telephone etiquette.	Communica tions	5	4.71	0.46	100
13	The ability to be an effective and responsive active listener.	Communica tions	5	4.71	0.53	96.7
14	The ability to explain complex issues to layman stakeholders.	Communica tions	5	4.68	0.48	100
15	The ability to interact well with stakeholder groups.	Communica tions	5	4.68	0.48	100
16	The ability to communicate using computer technology.	Communica tions	5	4.68	0.48	100
17	The ability to effectively manage and interact with diverse staff personnel.	Communica tions	5	4.61	0.50	100
18	The ability to effectively network and interact with diversified	Communica tions	5	4.61	0.50	100

(Table cont.)

	groups (e.g. public, private, academic, media).					
19	The ability to interact, communicate, and respond with others on a daily basis to facilitate effective "win-win" situation.	Communications	5	4.61	0.50	100
20	The ability to articulate natural resource knowledge and management intent to the public in an understandable manner, which requires understanding the audience's perspective.	Communications	5	4.61	0.56	96.7
21	The ability to be an effective public speaker.	Communications	5	4.58	0.62	93.5
22	The ability to speak to a group of people in a variety of forms and formats.	Communications	5	4.55	0.51	100
23	The ability to deal with and discuss controversial issues in an hostile environment.	Communications	5	4.55	0.57	96.7
24	The ability to navigate and locate information on the internet.	Communications	5	4.55	0.62	93.5
25	The ability to use software programs (e.g. PowerPoint) to construct one-on-one, lay-groups, professional, and web-based presentations to reach a diversity of audiences.	Communications	5	4.52	0.57	96.7
26	The ability to email correspondence.	Communications	5	4.48	0.89	90.3
27	The ability to communicate scientific information to managers and scientists with sound technical writing skills.	Communications	4	4.42	0.62	100
28	The ability to work with difficult people.	Communications	4	4.35	0.71	100
29	The ability to avoid or resolve potential human conflict situations with the most effective and appropriate conflict resolution methods.	Communications	4	4.29	0.74	100
30	The ability to communicate points convincingly to the public in print.	Communications	4	4.26	0.77	96.7

(Table cont.)

31	The ability to summarize and effectively communicate information through charts and figures for presentation and publication.	Communications	4	4.26	0.82	100
32	The ability to effectively present a professional presentation to a large audience.	Communications	4	4.16	0.78	100
33	The ability of the natural resource manager to effectively work with stakeholders through contemporary public relation practices.	Communications	4	4.16	0.86	96.7
34	The ability to effectively manage diverse visitors or user groups.	Communications	4	4.13	0.81	100
35	The ability to use specific knowledge to interact, influence, and communicate with community groups (action leaders, opinion leaders, etc.).	Communications	4	4.13	0.88	96.7
36	The ability to resolve conflict through consensus building.	Communications	4	3.94	0.81	96.7
37	The ability to effectively communicate ideas and technical information through popular publications.	Communications	4	3.90	0.83	96.7
38	The ability to use informed consent to effectively accomplish the mission, when consensus development is ineffective.	Communications	4	3.81	0.79	100
39	The ability to use marketing principles and effectively communicate ideas through educational and awareness programs to stakeholders.	Communications	4	3.77	0.84	96.7
40	The ability to edit and critically review communication media (manuscripts and presentations).	Communications	4	3.65	0.66	100
41	The ability to speak with the media and get your most important message across in a 30 second sound bite.	Communications	3	3.19	0.95	90.3
42	The ability to write grants.	Communications	3	2.87	0.72	100

(Table cont.)

Note. Mean ratings were classified according to the following interpretive scale: 5.00 – 4.50 = high importance; 4.49 – 3.50 = substantial importance; 3.49 – 2.50 = moderate importance; 2.49 – 1.50 = low importance; and 1.49 – 1.00 = no importance.
[a]Job skill area = curriculum content area as defined by The Wildlife Society (TWS) plus practical daily work skills.
[b]Median of ratings assigned by Delphi Panelists.
[c]Mean rating based on following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.
[d]Level of consensus = percentage of responding panelists within ± 1 of the median.

Round Three Policy Administration Entry-Level Job Skill Ratings.--Thirty-eight policy administration job skill items were rated by the Delphi panel using the following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance (Table 23). The items were then ranked by mean and classified using the following interpretive scale: 5.00 – 4.50 = "high importance"; 4.49 – 3.50 = "substantial importance"; 3.49 – 2.50 = "moderate importance"; 2.49 – 1.50 = "low importance"; and 1.49 – 1.00 = "no importance".

The highest rated item "The ability to work within existing laws, regulations, and policies" had a mean of 4.84 (SD = 0.37) and a 100% level of consensus. The lowest rated item "To have basic knowledge of business law" had a mean of 2.29 (SD = 0.90) and a 93.5 % level of consensus. Overall, three items were rated as "high importance" (5.00 – 4.50); 26 items were rated as "substantial importance" (4.49 – 3.50); eight items were rated as "moderate importance" (3.49 – 2.50); one item was rated as "low importance" (2.49 – 1.50); and no items were rated as no importance (1.49 – 1.00).

Table 23. Importance of Policy Administration Entry-Level Job Skills Needed by Wildlife Management Professionals as Perceived by Wildlife Management Experts in a Round Three Delphi Survey.

Rank	Item	Job Skill Area[a]	Med[b]	X[c]	SD	%[d]
1	The ability to work within existing laws, regulations, and policies.	Policy Admin	5	4.84	0.37	100

(Table cont.)

2	The ability to integrate the needs of wildlife, environment, and humans with natural resource management.	Policy Admin	5	4.65	0.55	96.7
3	The ability to understand the agency mission statement and the employee's contribution to accomplish the agency mission.	Policy Admin	5	4.61	0.56	96.7
4	To know the purpose and fundamentals of major natural resource laws (Clean Water Act, National Environmental Policy Act, Endangered Species Act, Lacey Act, Migratory Bird Treaty Act, etc.).	Policy Admin	5	4.45	0.62	93.5
5	The ability to recognize and understand state game laws.	Policy Admin	5	4.39	0.80	87.1
6	To have basic knowledge of the wildlife profession, prominent wildlife leaders, and the history of wildlife legislation in the U.S.A. (wildlife profession, Aldo Leopold, Pittman-Robertson, Lacy, ESA, etc.).	Policy Admin	4	4.29	0.74	100
7	The ability to recognize the differences between law, policy, and guidelines.	Policy Admin	4	4.26	0.82	100
8	The ability to understand how federal and state threatened/endangered species laws relate to the individual's workplace, agencies, and landowners.	Policy Admin	4	4.23	0.80	100
9	To have basic knowledge of major land programs affecting wildlife.	Policy Admin	4	4.19	0.79	100
10	The ability to interpret and apply regulation and policy in practical situations.	Policy Admin	4	4.16	0.78	100
11	To have basic knowledge and understanding of wetland regulations (Clean Water Act, Section 404, Food Securities Act, Wetland Reserve Program).	Policy Admin	4	4.06	0.81	100
12	The ability to effectively understand workplace policy	Policy Admin	4	4.06	0.85	100

(Table cont.)

	regarding employee supervision, hiring, firing, EEO, and budgeting.					
13	The ability to understand the roles and responsibilities of various local, state, and federal agencies.	Policy Admin	4	3.97	0.80	100
14	To be exposed to the role of government regulations and the importance of compliance.	Policy Admin	4	3.97	0.80	100
15	To have knowledge and understanding of non-government organizations in the natural resource field and their goals.	Policy Admin	4	3.94	0.77	100
16	To possess the basic knowledge of the origin and relevance of wildlife regulations.	Policy Admin	4	3.94	0.85	100
17	The ability to electronically and manually locate and understand local, state, and federal regulations that pertain to wildlife management.	Policy Admin	4	3.94	0.89	96.7
18	The ability to interpret and apply laws and policy to agency natural resource programs.	Policy Admin	4	3.9	0.83	100
19	The ability to understand how science informs policy and decision makers.	Policy Admin	4	3.84	0.90	96.7
20	The ability to understand how state legislative processes impact the agency's mission.	Policy Admin	4	3.81	0.87	96.7
21	The ability to possess a working knowledge of local, state, and national political and legislative processes to effectively accomplish organizational goals.	Policy Admin	4	3.77	0.80	96.7
22	The ability to understand how the federal legislative processes impact an agency's mission.	Policy Admin	4	3.77	0.8	100
23	The ability to understand the structure and function of federal agency administrations.	Policy Admin	4	3.77	0.84	96.7
24	To understand how federal, state, and other organizations classify species.	Policy Admin	4	3.77	0.99	90.3
25	The ability to understand the structure and function of state agency administrations.	Policy Admin	4	3.74	0.89	93.5

(Table cont.)

26	The ability to apply sensitivity training in the workplace.	Policy Admin	4	3.74	0.89	96.7
27	The ability to identify key governmental administrators that formulate wildlife policy.	Policy Admin	4	3.74	0.93	93.5
28	The ability to understand the various roles and responsibilities of federal and state government at the executive, legislative, and judicial levels.	Policy Admin	4	3.68	0.75	100
29	The ability to apply basic budgeting and accounting skills in the workplace.	Policy Admin	4	3.61	0.67	100
30	To know the agencies and CEOs that affect state and federal wildlife programs.	Policy Admin	3	3.42	0.85	90.3
31	The ability to apply basic knowledge of business administration and management in the workplace.	Policy Admin	3	3.23	0.76	93.5
32	To have basic knowledge in law enforcement and the wildlife agent's duties.	Policy Admin	3	3.16	0.78	93.5
33	To have knowledge of major case histories involving controversial resource issues such as the Monogahela decision, Everglades, Columbia River dams, Chesapeake Bay pesticides, Northwest old growth forests and Northwest Forest Plan by the Clinton Administration.	Policy Admin	3	3.1	0.94	93.5
34	To have basic knowledge of water rights law.	Policy Admin	3	3.06	0.77	96.7
35	The ability to formulate public use regulations.	Policy Admin	3	3.00	0.82	96.7
36	The ability to understand risk analysis and management.	Policy Admin	3	2.90	0.83	93.5
37	The ability to reference legal codes that provide the mandate for agency administration and operation.	Policy Admin	3	2.84	0.93	96.7
38	To have basic knowledge of business law.	Policy Admin	2	2.29	0.90	93.5

(Table cont.)

Note. Mean ratings were classified according to the following interpretive scale: 5.00 – 4.50 = high importance; 4.49 – 3.50 = substantial importance; 3.49 – 2.50 = moderate importance; 2.49 – 1.50 = low importance; and 1.49 – 1.00 = no importance.
[a]Job skill area = curriculum content area as defined by The Wildlife Society (TWS) plus practical daily work skills.
[b]Median of ratings assigned by Delphi Panelists.
[c]Mean rating based on following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.
[d]Level of consensus = percentage of responding panelists within $\pm$ 1 of the median.

Round Three Practical Daily Entry-Level Job Skill Ratings.--Fifty-four practical daily job skill items were rated by the Delphi panel using the following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance (Table 24). The items were then ranked by mean and classified using the following interpretive scale: 5.00 – 4.50 = "high importance"; 4.49 – 3.50 = "substantial importance"; 3.49 – 2.50 = "moderate importance"; 2.49 – 1.50 = "low importance"; and 1.49 – 1.00 = "no importance".

The highest rated item "The ability to be an ethical wildlife manager" had a mean of 4.94 (SD = 0.25) and a 100% level of consensus. The lowest rated item "The ability to fabricate metal (welding/cutting operations)" had a mean of 1.77 (SD = 0.76) and a 100 % level of consensus. Overall 15 items were rated as "high importance" (5.00 – 4.50); 16 items were rated as "substantial importance" (4.49 – 3.50); 17 items were rated as "moderate importance" (3.49 – 2.50); six items were rated as "low importance" (2.49 – 1.50); and no items were rated as no importance (1.49 – 1.00).

Table 24. Importance of Practical Daily Entry-Level Job Skills Needed by Wildlife Management Professionals as Perceived by Wildlife Management Experts in a Round Three Delphi Survey.

Rank	Item	Job Skill Area[a]	Med[b]	X[c]	SD	%[d]
1	The ability to be an ethical wildlife manager.	Practical	5	4.94	0.25	100

(Table cont.)

2	The ability to be an accountable and dependable self-starter who can work independently, efficiently, and safely with minimal supervision in all settings (individual, group, office, laboratory, field).	Practical	5	4.87	0.34	100
3	The ability to maintain a good attitude. Regardless of training, attitude is the best predictor of success. Individuals who are fair and honest with others are successful. Even if an individual, with only average intelligence and training, who can effectively deal with others, will succeed better than most others.	Practical	5	4.87	0.34	100
4	The ability to develop and possess good observational skills.	Practical	5	4.87	0.35	96.7
5	The ability to establish credibility with colleagues and the public.	Practical	5	4.84	0.37	100
6	The ability and willingness to learn new "things" in everyday life (life-long learning through reading, conferences, etc.).	Practical	5	4.81	0.40	100
7	The ability to balance family and work.	Practical	5	4.81	0.40	100
8	The ability to manage time (time management).	Practical	5	4.81	0.40	100
9	The ability to understand habitat and population manipulation as wildlife management tools.	Practical	5	4.81	0.48	96.7
10	The ability to recognize and accept goals of the employer.	Practical	5	4.77	0.43	100
11	The ability to use computers for word processing, developing PowerPoint presentations, canned programs (Program Mark and Program Distance), database management, and statistical packages.	Practical	5	4.74	0.51	96.7
12	The ability to work with management and research personnel of the public and private	Practical	5	4.68	0.48	100

(Table cont.)

	sectors.					
13	The ability to apply coursework to a field setting for writing a management plan and report writing.	Practical	5	4.61	0.56	96.7
14	The ability to identify potential ecological problems in the field.	Practical	5	4.52	0.51	100
15	The ability to use the scientific method for basic research and problem solving in wildlife management.	Practical	5	4.52	0.68	96.7
16	The ability to develop and organize annual and weekly work plans.	Practical	5	4.45	0.62	93.5
17	The ability to navigate in a forest landscape using maps/photos.	Practical	5	4.42	0.72	93.5
18	The ability to navigate by GPS, map, and compass.	Practical	4	4.39	0.72	96.7
19	The demonstrated ability to tolerate adverse field conditions and excel under extended duty in the field.	Practical	5	4.39	0.76	90.3
20	To have well grounded training in conservation ethics issues	Practical	5	4.35	1.05	87.1
21	The ability to indicate wildlife work experience on your resume (volunteer, internship, summer employment).	Practical	4	4.16	0.78	100
22	The ability to maneuver a 4-wheel drive vehicle with a standard or automatic transmission.	Practical	4	4.13	0.85	100
23	The ability to operate a vehicle with a standard or automatic transmission.	Practical	4	4.13	0.88	96.7
24	The ability to install, maintain, and use basic field sampling equipment.	Practical	4	4.00	0.82	100
25	The ability to use Microsoft Office Suite for word-processing, presenting, database management, and data analysis.	Practical	4	4.00	0.93	93.5
26	The ability to maneuver a vehicle and trailer.	Practical	4	3.81	0.91	96.7
27	To have knowledge of and safely use firearms.	Practical	4	3.77	1.2	87.1

(Table cont.)

28	To have basic camping and outdoor survival skills.	Practical	4	3.71	0.94	93.5
29	To have knowledge of different types of hunting equipment.	Practical	4	3.65	0.98	87.1
30	The ability to locate and identify potential employment opportunities.	Practical	4	3.55	0.81	96.7
31	The ability to operate an ATV as indicated by training certification.	Practical	4	3.55	1.12	80.6
32	The ability to follow basic laboratory procedures.	Practical	3	3.39	0.67	96.7
33	The ability to perform routine service and emergency repair of vehicles and equipment.	Practical	3	3.23	0.76	96.7
34	To be first aid and CPR qualified.	Practical	3	3.19	0.98	87.1
35	To have basic knowledge and use of various farm equipment and implements.	Practical	3	3.16	0.90	93.5
36	The ability to document information via camera operation.	Practical	3	3.16	0.90	93.5
37	The ability to effectively manage relationships with lessees (e.g. hunting clubs).	Practical	3	3.16	0.93	90.3
38	The ability to operate hand-held computers.	Practical	3	3.13	0.72	100
39	To have basic knowledge and basic abilities to use hand tools for carpentry, electrical, plumbing, metal fabrication, and general maintenance.	Practical	3	3.13	0.81	96.7
40	The ability to understand the basics of fire and fire fighting (wildland fire training/certification: Federal s130/190).	Practical	3	3.13	0.81	96.7
41	The ability to use a winch on a vehicle.	Practical	3	3.10	0.87	90.3
42	The ability to operate a motorized boat as indicated by training certification.	Practical	3	3.00	0.93	96.7

(Table cont.)

43	To have knowledge of different types of fishing equipment.	Practical	3	2.97	0.84	96.7
44	The ability to communicate by radio.	Practical	3	2.94	0.89	93.5
45	To be defensive driving certified.	Practical	3	2.90	1.11	83.8
46	To have basic knowledge of construction.	Practical	3	2.84	0.93	90.3
47	The ability to safely operate a chainsaw and properly fell a tree.	Practical	3	2.84	0.93	93.5
48	The ability to read and follow blueprints and shop drawings.	Practical	3	2.81	0.83	93.5
49	To have basic knowledge and use of heavy equipment.	Practical	2	2.35	0.91	90.3
50	The basic ability for repair and maintenance of computers (troubleshooting for repair and maintenance).	Practical	2	2.19	0.75	100
51	To have experience in small aircraft and helicopters	Practical	2	2.13	0.72	100
52	To have experience in fish shocking equipment.	Practical	2	1.97	0.75	100
53	To have experience with wetsuits/snorkeling.	Practical	2	1.84	0.73	100
54	The ability to fabricate metal (welding/cutting operations).	Practical	2	1.77	0.76	100

Note. Mean ratings were classified according to the following interpretive scale: 5.00 – 4.50 = high importance; 4.49 – 3.50 = substantial importance; 3.49 – 2.50 = moderate importance; 2.49 – 1.50 = low importance; and 1.49 – 1.00 = no importance.
[a]Job skill area = curriculum content area as defined by The Wildlife Society (TWS) plus practical daily work skills.
[b]Median of ratings assigned by Delphi Panelists.
[c]Mean rating based on following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.
[d]Level of consensus = percentage of responding panelists within $\pm$ 1 of the median.

Summary of Round Three Entry-Level Job Skills.--Overall, 384 entry-level job skill items were rated by the Delphi Panel using the following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and

1 = no importance (Table 24). The items were then ranked by mean and classified using the following interpretive scale: 5.00 – 4.50 = “high importance”; 4.49 – 3.50 = “substantial importance”; 3.49 – 2.50 = “moderate importance”; 2.49 – 1.50 = “low importance”; and 1.49 – 1.00 = “no importance” (Table 25). The highest rated item “To have a strong foundation in wildlife management principles and techniques” had a mean of 4.97 (SD = 0.18). The lowest rated item “The ability to fabricate metal (wielding/cutting operations)” had a mean of 1.79 (SD = 0.76). Overall, 72 items were rated as “high importance” (5.00 – 4.50); 175 items were rated as “substantial importance” (4.49 - 3.50); 123 items were rated as “moderate importance” (3.49 – 2.50); 14 items were rated as “low importance” (2.49 – 1.50); and no items were rated as no importance (1.49 – 0.00).

Table 25. Importance Ranking All Entry-Level Job Skills Needed by Wildlife Management Professionals as Perceived by Wildlife Management Experts in a Round Three Delphi Survey.

Rank	Item	Job Skill Area[a]	Med[b]	X[c]	SD	%[d]
1	To have a strong foundation in wildlife management principles and techniques.	Biological Sciences	5	4.97	0.18	100
2	To have a sound understanding of ecological principles and concepts of the relationships between plants, animals, and the environment.	Biological Sciences	5	4.94	0.25	100
3	The ability to be an ethical wildlife manager.	Practical Daily Skills	5	4.94	0.25	100
4	The ability to locate and interpret reliable information.	Biological Sciences	5	4.90	0.30	100
5	The ability to accurately measure and record data.	Quantita-tive Sciences	5	4.90	0.30	100
6	The ability to write a simple technical report.	Communi-cations	5	4.90	0.30	100
7	The ability to write plans, reports, technical papers, and other documents using good grammar,	Communi-cations	5	4.90	0.30	100

(Table cont.)

	punctuation, and techniques.					
8	The ability to write plans, reports, technical papers, and other documents using good grammar, punctuation, and techniques.	Communi-cations	5	4.90	0.30	100
9	To have a sound foundation in biology.	Biological Sciences	5	4.87	0.34	100
10	The ability to skillfully communicate with diverse groups and individuals.	Communi-cations	5	4.87	0.34	100
11	The ability to be an accountable and dependable self-starter who can work independently, efficiently, and safely with minimal supervision in all settings (individual, group, office, laboratory, field).	Practical Daily Skills	5	4.87	0.34	100
12	The ability to maintain a good attitude. Regardless of training, attitude is the best predictor of success. Individuals who are fair and honest with others are successful. Even if an individual, with only average intelligence and training, who can effectively deal with others, will succeed better than most others.	Practical Daily Skills	5	4.87	0.34	100
13	The ability to develop and possess good observational skills.	Practical Daily Skills	5	4.87	0.35	96.7
14	To have a sound foundation of wildlife ecological principles and processes.	Biological Sciences	5	4.84	0.37	100
15	To be knowledgeable of wildlife habitat management principles, tools, and techniques.	Biological Sciences	5	4.84	0.37	100
16	The ability to professionally and effectively communicate one-on-one at any level of understanding (technical and lay person).	Communi-cations	5	4.84	0.37	100
17	The ability to keep a positive, friendly, and outgoing attitude.	Communi-cations	5	4.84	0.37	100
18	The ability to work within existing laws, regulations, and policies.	Policy Administra-tion	5	4.84	0.37	100

(Table cont.)

19	The ability to establish credibility with colleagues and the public.	Practical Daily Skills	5	4.84	0.37	100
20	To be familiar with general wildlife sampling methods.	Quantita-tive Sciences	5	4.81	0.40	100
21	The ability to develop personal environmental ethics and a resource philosophy.	Humanities	5	4.81	0.40	100
22	The ability to develop and maintain interpersonal relationships.	Communi-cations	5	4.81	0.40	100
23	The ability to be a team player and recognize the role of effective teamwork in organizations.	Communi-cations	5	4.81	0.40	100
24	The ability and willingness to learn new "things" in everyday life (life-long learning through reading, conferences, etc.)	Practical Daily Skills	5	4.81	0.40	100
25	The ability to balance family and work.	Practical Daily Skills	5	4.81	0.40	100
26	The ability to manage time (time management).	Practical Daily Skills	5	4.81	0.40	100
27	The ability to understand habitat and population manipulation as wildlife management tools.	Practical Daily Skills	5	4.81	0.48	96.7
28	The ability to lead and follow as the situation warrants.	Communi-cations	5	4.77	0.43	100
29	The ability to recognize and accept goals of the employer.	Practical Daily Skills	5	4.77	0.43	100
30	To understand the need for conserving and protecting biodiversity in management planning.	Biological Sciences	5	4.74	0.44	100
31	To have a basic understanding of ecology (population, community, and ecosystem).	Biological Sciences	5	4.74	0.44	100
32	The ability to locate and retrieve reliable wildlife information from the library and internet resources.	Humanities	5	4.74	0.44	100
33	The ability to develop and maintain partnerships in wildlife management.	Humanities	5	4.74	0.51	96.7
34	The ability to use computers for word processing, developing PowerPoint presentations, canned programs (Program Mark and	Practical Daily Skills	5	4.74	0.51	96.7

(Table cont.)

	Program Distance), database management, and statistical packages.					
35	To understand the application of statistics to wildlife management and research.	Basic Statistics	5	4.71	0.46	100
36	The ability to professionally present information to a group of peers.	Communi-cations	5	4.71	0.46	100
37	The ability to write effectively for various audiences.	Communi-cations	5	4.71	0.46	100
38	The ability to communicate through written professional correspondence.	Communi-cations	5	4.71	0.46	100
39	The ability to communicate through good telephone etiquette.	Communi-cations	5	4.71	0.46	100
40	The ability to read and interpret scientific articles to understand the study results.	Basic Statistics	5	4.71	0.53	96.7
41	The ability to be an effective and responsive active listener.	Communi-cations	5	4.71	0.53	96.7
42	The ability to function as a well-rounded member of society.	Humanities	5	4.68	0.48	100
43	The ability to understand private landowner needs and their relationship to wildlife and land management.	Humanities	5	4.68	0.48	100
44	The ability to explain complex issues to layman stakeholders.	Communi-cations	5	4.68	0.48	100
45	The ability to interact well with stakeholder groups.	Communi-cations	5	4.68	0.48	100
46	The ability to communicate using computer technology.	Communi-cations	5	4.68	0.48	100
47	The ability to work with management and research personnel of the public and private sectors.	Practical Daily Skills	5	4.68	0.48	100
48	The ability to use the internet and computer as tools to aid in biological/habitat management.	Biological Sciences	5	4.65	0.49	100
49	The ability to locate, read, and comprehend reliable life history knowledge of mammals, birds, reptiles, amphibians, fish, insects, and other invertebrates.	Biological Sciences	5	4.65	0.55	96.7

(Table cont.)

50	To have basic computational skills.	Quanti-tative Sciences	5	4.65	0.55	96.7
51	The ability to integrate the needs of wildlife, environment, and humans with natural resource management.	Policy Administra-tion	5	4.65	0.55	96.7
52	The ability to implement and assess the impacts of management on target and non-target species.	Biological Sciences	5	4.61	0.50	100
53	To have a foundation of wildlife conservation and land management history.	Humanities	5	4.61	0.50	100
54	The ability to effectively manage and interact with diverse staff personnel.	Communi-cations	5	4.61	0.50	100
55	The ability to effectively network and interact with diversified groups (e.g. public, private, academic, media).	Communi-cations	5	4.61	0.50	100
56	The ability to interact, communicate, and respond with others on a daily basis to facilitate effective "win-win" situation.	Communi-cations	5	4.61	0.50	100
57	The ability to articulate natural resource knowledge and management intent to the public in an understandable manner, which requires understanding the audience's perspective.	Communi-cations	5	4.61	0.56	96.7
58	The ability to understand the agency mission statement and the employee's contribution to accomplish the agency mission.	Policy Administra-tion	5	4.61	0.56	96.7
59	The ability to apply coursework to a field setting for writing a management plan and report writing.	Practical Daily Skills	5	4.61	0.56	96.7
60	The ability to work professionally in order to be accepted as professionals by future society.	Humanities	5	4.61	0.62	93.5
61	To have knowledge of sampling principles for assessing wildlife populations and wildlife habitat.	Basic Statistics	5	4.58	0.50	100
62	To understand the difference between inventorying (what's	Quanti-tative	5	4.58	0.56	96.7

(Table cont.)

		Sciences				
	there), monitoring (what's it doing), and research (why's it doing that).	Quanti-tative Sciences	5	4.58	0.56	96.7
63	The ability to be an effective public speaker.	Communi-cations	5	4.58	0.62	93.5
64	The ability to speak to a group of people in a variety of forms and formats.	Communi-cations	5	4.55	0.51	100
65	To understand the value of scientific survey sampling in wildlife management.	Statistics	5	4.55	0.57	96.7
66	The ability to deal with and discuss controversial issues in a hostile environment.	Communi-cations	5	4.55	0.57	96.7
67	The ability to navigate and locate information on the internet.	Communi-cations	5	4.55	0.62	93.5
68	The ability to identify potential ecological problems in the field.	Practical Daily Skills	5	4.52	0.51	100
69	To have a sound foundation of plant ecological principles and processes.	Biological Sciences	5	4.52	0.57	96.7
70	To have knowledge of basic land uses (e.g. aquaculture, crop production, forestry, grazing, and wildlife).	Biological Sciences	5	4.52	0.57	96.7
71	The ability to use software programs (e.g. PowerPoint) to construct one-on-one, lay-groups, professional, and web-based presentations to reach a diversity of audiences.	Communi-cations	5	4.52	0.57	96.7
72	To have a basic understanding of statistical methods to estimate wildlife populations.	Basic Statistics	5	4.52	0.63	93.
73	The ability to use the scientific method for basic research and problem solving in wildlife management.	Practical Daily Skills	5	4.52	0.68	96.7
74	To have knowledge of wetland ecology and management.	Biological Sciences	5	4.48	0.57	96.7
75	The ability to recognize a statistically valid sample versus some "neat information."	Basic Statistics	5	4.48	0.57	96.7

(Table cont.)

76	To have basic knowledge of forest management practices.	Biological Sciences	5	4.48	0.63	93.5
77	The ability to recognize the history, role, and importance of consumptive wildlife use (hunting, fishing, and trapping) as a wildlife conservation/management tool.	Humanities	5	4.48	0.68	90.3
78	To understand wildlife harvest management concepts and implications when developing management plans.	Biological Sciences	5	4.48	0.72	93.5
79	The ability to email correspondence.	Communi-cations	5	4.48	0.89	90.3
80	To have a broad understanding of vegetative sampling techniques commonly used in modern land management activities.	Quanti-tative Sciences	4	4.45	0.57	100
81	To know the purpose and fundamentals of major natural resource laws (Clean Water Act, National Environmental Policy Act, Endangered Species Act, Lacey Act, Migratory Bird Treaty Act, etc.).	Policy Administra-tion	5	4.45	0.62	93.5
82	The ability to develop and organize annual and weekly work plans.	Practical Daily Skills	5	4.45	0.62	93.5
83	To be knowledgeable in forest ecology and management.	Biological Sciences	5	4.45	0.68	90.3
84	The ability to communicate scientific information to managers and scientists with sound technical writing skills.	Communi-cations	4	4.42	0.62	100
85	The ability to navigate in a forest landscape using maps/photos.	Practical Daily Skills	5	4.42	0.72	93.5
86	The ability to utilize man-made practices as useful ecological management tools (grazing, prescribed fire, herbicide application, logging, agronomic practices, etc).	Biological Sciences	5	4.42	0.76	90.3
87	The ability to conduct simple analysis with guidance from a scientist or biometrician.	Basic Statistics	5	4.42	0.81	96.7
88	The ability to navigate by GPS, map, and compass.	Practical Daily Skills	4	4.39	0.72	96.7

(Table cont.)

89	The ability to implement and assess habitat management techniques on target and non-target species habitat.	Biological Sciences	5	4.39	0.72	87.1
90	The demonstrated ability to tolerate adverse field conditions and excel under extended duty in the field.	Practical Daily Skills	5	4.39	0.76	90.3
91	The ability to recognize and understand state game laws.	Policy Administra-tion	5	4.39	0.80	87.1
92	The ability to determine and identify species-specific habitat requirements.	Biological Sciences	4	4.35	0.61	100
93	The ability to determine and identify species-specific limiting factors.	Biological Sciences	4	4.35	0.71	100
94	The ability to develop, implement, and complete comprehensive wildlife management plans for individual species and groups of species.	Quantita-tive Sciences	4	4.35	0.71	100
95	The ability to work with difficult people.	Communi-cations	4	4.35	0.71	100
96	The ability to understand basic (inferential) statistical concepts.	Basic Statistics	4	4.35	0.84	96.7
97	To be familiar with localized endangered and threatened species.	Biological Sciences	5	4.35	0.84	90.3
98	To have well grounded training in conservation ethics issues.	Practical Daily Skills	5	4.35	1.05	87.1
99	To have a working understanding of population dynamic principles.	Biological Sciences	4	4.29	0.69	100
100	The ability to use GIS, GPS, aerial photography, cartography, and map reading for natural resource management planning, monitoring, and assessment.	Quantita-tive Sciences	4	4.29	0.69	100
101	The ability to avoid or resolve potential human conflict situations with the most effective and appropriate conflict resolution methods.	Communi-cations	4	4.29	0.74	100
102	To have basic knowledge of the wildlife profession, prominent wildlife leaders, and the history of	Policy Administra-tion	4	4.29	0.74	100

(Table cont.)

	wildlife legislation in the U.S.A. (wildlife profession, Aldo Leopold, Pittman-Robertson, Lacy, ESA, etc.).	Policy Administra-tion	4	4.29	0.74	100
103	To have well grounded training in the conservation and protection of biodiversity in management planning	Biological Sciences	5	4.29	1.04	80.6
104	The ability to apply the concepts of accuracy, precision and the scientific method for hypothesis testing.	Basic Statistics	4	4.26	0.73	100
105	To understand the effect of sample size on research findings and management outcomes.	Basic Statistics	4	4.26	0.77	100
106	The ability to understand public perception of wildlife and associated habitats.	Humanities	4	4.26	0.77	100
107	The ability to communicate points convincingly to the public in print.	Communi-cations	4	4.26	0.77	96.7
108	The ability to summarize and effectively communicate information through charts and figures for presentation and publication.	Communi-cations	4	4.26	0.82	100
109	The ability to recognize the differences between law, policy, and guidelines.	Policy Administra-tion	4	4.26	0.82	100
110	The ability to organize survey sampling and monitoring techniques for plants to evaluate wildlife habitat (e.g. imagery; sampling methods - transects (random, stratified, cluster), data (plots, plotless, point intercept).	Quantita-tive Sciences	4	4.23	0.56	100
111	The ability to use plant community indices to determine wildlife habitat value.	Physical Science	4	4.23	0.67	100
112	The ability to organize survey sampling and monitoring techniques for wildlife (mammals, birds, reptiles, amphibians, fish, and invertebrates) (e.g. capture, marking, radio telemetry, sexing, ageing).	Quantita-tive Sciences	4	4.23	0.67	100

(Table cont.)

113	The ability to recognize variables and relationships within an ecosystem (plant-animal-environment).	Biological Sciences	4	4.23	0.76	100
114	To have a sound foundation in botany.	Biological Sciences	4	4.23	0.76	100
115	The ability to understand how federal and state threatened/endangered species laws relate to the individual's workplace, agencies, and landowners.	Policy Administra-tion	4	4.23	0.80	100
116	The ability to understand the need for social acceptance of consumptive natural resource use (hunting, trapping, and fishing).	Humanities	4	4.23	0.80	96.7
117	To have knowledge of techniques for estimating animal density and diversity.	Biological Sciences	4	4.19	0.65	100
118	The ability to locate species specific plant life history and determine plant species value to wildlife.	Biological Sciences	4	4.19	0.70	100
119	To understand the basic variables and relationships of wildlife population dynamics.	Basic Statistics	4	4.19	0.75	100
120	The ability to design, implement, and interpret field surveys.	Quantita-tive Sciences	4	4.19	0.75	100
121	To have basic knowledge of major land programs affecting wildlife.	Policy Administra-tion	4	4.19	0.79	100
122	The ability to apply ecological concepts and models to problems in natural resource and ecosystem management.	Biological Sciences	4	4.19	0.83	100
123	The ability to identify and utilize specific state-of-the-art wildlife management methods and techniques for high profile non-game species.	Biological Sciences	4	4.16	0.69	100
124	The ability to effectively present a professional presentation to a large audience.	Communi-cations	4	4.16	0.78	100
125	The ability to interpret and apply regulation and policy in practical	Policy	4	4.16	0.78	100

(Table cont.)

	situations.	Administra-tion	4	4.16	0.78	100
126	The ability to indicate wildlife work experience on your resume (volunteer, internship, summer employment).	Practical Daily Skills	4	4.16	0.78	100
127	The ability to identify and utilize state-of-the-art wildlife management techniques for major game species.	Biological Sciences	4	4.16	0.82	96.7
128	To have knowledge of the urban/wild land interface.	Quantita-tive Sciences	4	4.16	0.86	100
129	The ability of the natural resource manager to effectively work with stakeholders through contemporary public relation practices.	Communi-cations	4	4.16	0.86	96.7
130	To have the basic understanding of landscape ecology for ecosystem restoration and management planning.	Biological Sciences	4	4.16	0.97	96.7
131	To have an understanding of conservation biology.	Humanities	4	4.16	0.97	96.7
132	To have knowledge of all basic wildlife courses.	Biological Sciences	4	4.16	0.97	96.7
133	To have the basic knowledge and familiarity with modern surface mapping and remote sensing techniques to include computer usage, GIS, GPS, aerial photography, satellite imagery, and cartography to model, monitor, and assess natural resources.	Quantita-tive Sciences	4	4.13	0.76	100
134	The ability to effectively manage diverse visitors or user groups.	Communi-cations	4	4.13	0.81	100
135	The ability to maneuver a 4-wheel drive vehicle with a standard or automatic transmission.	Practical Daily Skills	4	4.13	0.85	100
136	The ability to use specific knowledge to interact, influence, and communicate with community groups (action leaders, opinion leaders, etc.).	Communi-cations	4	4.13	0.88	96.7

(Table cont.)

137	The ability to operate a vehicle with a standard or automatic transmission.	Practical Daily Skills	4	4.13	0.88	96.7
138	To have knowledge of the agriculture/wild land interface.	Quantita-tive Sciences	4	4.13	0.92	100
139	The ability to perform routine analysis of raw data using descriptive statistics.	Basic Statistics	4	4.13	0.92	96.7
140	The ability to recognize the social implications of wildlife management actions and pre-planning responses to questions and challenges made by those who do not understand or support hunting as a wildlife management tool.	Humanities	4	4.10	0.83	96.7
141	To have a working knowledge for ageing, sexing, trapping, capturing, handling, marking, and radio telemetry tracking of wildlife.	Biological Sciences	4	4.10	0.87	100
142	The ability to visually and auditorially identify wildlife.	Biological Sciences	4	4.06	0.73	100
143	To have basic knowledge and understanding of wetland regulations (Clean Water Act, Section 404, Food Securities Act, Wetland Reserve Program).	Policy Administra-tion	4	4.06	0.81	100
144	The ability to recognize, understand, and appreciate diverse cultural perspectives regarding wildlife values (stakeholder diversity).	Humanities	4	4.06	0.85	100
145	The ability to effectively understand workplace policy regarding employee supervision, hiring, firing, EEO, and budgeting.	Policy Administra-tion	4	4.06	0.85	100
146	The ability to use descriptive statistics in the biometric analysis of wildlife phenomenon.	Basic Statistics	4	4.06	0.89	96.7
147	To have basic knowledge of ornithology.	Biological Sciences	4	4.03	0.71	100
148	The ability to merge the management principles of upland, wetland, and aquatic systems to	Biological Sciences	4	4.03	0.80	100

(Table cont.)

	meet wildlife management and biodiversity objectives.					
149	The ability to recognize how diverse social values affect wildlife management decisions.	Humanities	4	4.03	0.80	100
150	The ability to implement forest management and silvicultural practices for wildlife habitat restoration, maintenance, and management.	Biological Sciences	4	4.03	0.84	100
151	The ability to identify the current successional stage of a plant community and predict the wildlife inhabitants.	Biological Sciences	4	4.03	0.84	96.7
152	The ability to understand that changing U.S. demographics will impact future wildlife management.	Humanities	4	4.03	0.91	96.7
153	The ability to identify the successional stage of a plant community.	Biological Sciences	4	4.03	0.91	93.5
154	To understand the importance of indicator species habitat requirements when preparing and implementing management strategies.	Biological Sciences	4	4.0	0.82	100
155	The ability to recognize human need for outdoor recreation and to understand the apparent implications if that need is denied or suppressed (conflict management).	Humanities	4	4.0	0.82	100
156	The ability to recognize and understand diverse cultural natural resource values.	Humanities	4	4.0	0.82	100
157	The ability to install, maintain, and use basic field sampling equipment.	Practical Daily Skills	4	4.0	0.82	100
158	The ability to recognize the value of human diversity in the workplace.	Humanities	4	4.0	0.86	100
159	To have a sound foundation of zoology.	Biological Sciences	4	4.0	0.86	96.7
160	The ability to use Microsoft Office Suite for word-processing, presenting, database management,	Practical Daily Skills	4	4.0	0.93	93.5

(Table cont.)

	and data analysis.					
161	To have basic knowledge of mammology.	Biological Sciences	4	3.97	0.71	100
162	The ability to understand the roles and responsibilities of various local, state, and federal agencies.	Policy Administra-tion	4	3.97	0.80	100
163	To be exposed to the role of government regulations and the importance of compliance.	Policy Administra-tion	4	3.97	0.80	100
164	To have the basic understanding of wild land fire ecology.	Biological Sciences	4	3.97	0.84	100
165	To develop critical quantitative thinking skills by completing math courses through college algebra.	Quantita-tive Sciences	4	3.97	0.84	100
166	The ability to relate wildlife or habitat trends to human dynamics.	Humanities	4	3.97	0.84	100
167	To understand and appreciate diverse human cultures and associated wildlife value systems.	Humanities	4	3.97	0.87	100
168	The ability to identify mammals, birds, reptiles, amphibians, and fish to species; insects to order; other invertebrates to phyla and order through the use of a key.	Biological Sciences	4	3.97	0.91	96.7
169	To recognize the impact of giving animals' human traits by TV and other media, which will affect society's acceptance of consumptive wildlife use (hunting and trapping).	Humanities	4	3.97	0.98	90.3
170	The ability to sex wildlife.	Biological Sciences	4	3.97	1.02	93.5
171	To have knowledge of techniques for estimating plant density and diversity.	Biological Sciences	4	3.94	0.68	100
172	The ability to identify wildlife habitat use by wildlife sign.	Biological Sciences	4	3.94	0.77	100
173	To have knowledge and understanding of non-government organizations in the natural resource field and their goals.	Policy Administra-tion	4	3.94	0.77	100
174	To have a basic knowledge of hydrology.	Physical Science	4	3.94	0.81	96.7

(Table cont.)

175	The ability to resolve conflict through consensus building.	Communi-cations	4	3.94	0.81	96.7
176	To possess the basic knowledge of the origin and relevance of wildlife regulations.	Policy Administra-tion	4	3.94	0.85	100
177	The ability to electronically and manually locate and understand local, state, and federal regulations that pertain to wildlife management.	Policy Administra-tion	4	3.94	0.89	96.7
178	To have experience in statistical procedure and data analysis.	Basic Statistics	4	3.94	0.93	96.7
179	The ability to use statistics to plan, implement, and assess science-based wildlife management programs (adaptive resource management).	Basic Statistics	4	3.90	0.70	100
180	To have knowledge of political and social history at the local, state, and national level, which involves wildlife management.	Humanities	4	3.90	0.75	100
181	The ability to develop, implement, and manage an adaptive resource habitat management plan.	Biological Sciences	4	3.90	0.79	100
182	To understand the relationship between abiotic factors (climate, hydrology, soils) and biotic productivity and diversity.	Physical Science	4	3.90	0.79	100
183	The ability to interpret and apply laws and policy to agency natural resource programs.	Policy Administra-tion	4	3.90	0.83	100
184	The ability to understand "anti-group stakeholders" (e.g. PETA) and their perspectives.	Humanities	4	3.90	0.83	96.7
185	The ability to effectively communicate ideas and technical information through popular publications.	Communi-cations	4	3.90	0.83	96.7
186	The ability to implement adaptive resource management to evaluate habitat response and future management options.	Biological Sciences	4	3.87	0.81	100
187	To have knowledge of the factors affecting wildlife growth, reproduction, fitness, and survival including knowledge of diseases	Biological Sciences	4	3.84	0.69	100

(Table cont.)

	and genetics.					
188	To be introduced to modeling as a wildlife management tool.	Quantita-tive Science	4	3.84	0.69	100
189	The ability to determine and identify species-specific predator/prey relationships.	Biological Sciences	4	3.84	0.78	96.7
190	The ability to handle wildlife.	Biological Sciences	4	3.84	0.82	96.7
191	The ability to apply real world economics and capitalism in wildlife management.	Humanities	4	3.84	0.86	100
192	The ability to key-out an avian species.	Biological Sciences	4	3.84	0.90	96.7
193	To have knowledge of waterfowl management techniques.	Biological Sciences	4	3.84	0.90	96.7
194	The ability to understand how science informs policy and decision makers.	Policy Administra-tion	4	3.84	0.90	96.7
195	To have knowledge of forest management techniques that pertain to forest dwelling migratory birds.	Biological Sciences	4	3.81	0.75	100
196	The ability to understand historical and contemporary roles of society in wildlife management.	Humanities	4	3.81	0.75	100
197	The ability to use informed consent to effectively accomplish the mission, when consensus development is ineffective.	Communi-cations	4	3.81	0.79	100
198	The ability to design a sampling survey and analyze the survey data to estimate and monitor population trends.	Basic Statistics	4	3.81	0.83	100
199	The ability to understand how state legislative processes impact the agency's mission.	Policy Administra-tion	4	3.81	0.87	96.7
200	The ability to maneuver a vehicle and trailer.	Practical Daily Skills	4	3.81	0.91	96.7
201	The ability to use contemporary soil erosion control techniques within the wildlife management area.	Physical Science	4	3.77	0.76	100
202	The ability to implement and assess appropriate aquatic habitat management techniques.	Physical Science	4	3.77	0.76	100

(Table cont.)

203	The ability to identify, sex, and age waterfowl.	Biological Sciences	4	3.77	0.80	100
204	The ability to understand how the federal legislative processes impact an agency's mission.	Policy Administra-tion	4	3.77	0.80	100
205	To have basic knowledge and skills of dendrology (keying, collecting, preserving, and ageing plants).	Biological Sciences	4	3.77	0.80	96.7
206	The ability to estimate and identify surface features through aerial photograph interpretation.	Quantita-tive Science	4	3.77	0.80	96.7
207	The ability to possess a working knowledge of local, state, and national political and legislative processes to effectively accomplish organizational goals.	Policy Administra-tion	4	3.77	0.80	96.7
208	The ability to use marketing principles and effectively communicate ideas through educational and awareness programs to stakeholders.	Communi-cations	4	3.77	0.84	96.7
209	The ability to understand the structure and function of federal agency administrations.	Policy Administra-tion	4	3.77	0.84	96.7
210	To understand how federal, state, and other organizations classify species.	Policy Administra-tion	4	3.77	0.99	90.3
211	To have knowledge of and safely use firearms.	Practical Daily Skills	4	3.77	1.20	87.1
212	The ability to identify wetland plant species and community composition to determine the wetland ecosystem type.	Biological Sciences	4	3.74	0.68	100
213	The ability to key-out regional and national plant species.	Biological Sciences	4	3.74	0.73	100
214	The ability to apply population models as wildlife management tools (population estimates, indices, life tables and projection, survival, band return, capture-recapture models, sightability models, and minimum viable population analysis).	Quantita-tive Science	4	3.74	0.73	100

(Table cont.)

215	To have basic knowledge of agronomy (soil characteristics, identification, and productivity).	Physical Science	4	3.74	0.77	100
216	The ability to determine the appropriate sample size for wildlife research and adaptive resource management.	Basic Statistics	4	3.74	0.82	96.7
217	The ability to use descriptive statistics to conduct habitat analysis and predict future habitat changes.	Basic Statistics	4	3.74	0.86	96.7
218	The ability to use scientific journal writings to develop a theoretical approach to problem solving.	Basic Statistics	4	3.74	0.86	96.7
219	The ability to apply sensitivity training in the workplace.	Policy Administra-tion	4	3.74	0.89	96.7
220	The ability to use current methods of plant eradication to control invasive exotic species for habitat restoration and management.	Biological Sciences	4	3.74	0.89	93.5
221	The ability to understand the structure and function of state agency administrations.	Policy Administra-tion	4	3.74	0.89	93.5
222	The ability to identify key governmental administrators that formulate wildlife policy.	Policy Administra-tion	4	3.74	0.93	93.5
223	The ability to use statistical software packages to record and evaluate data.	Basic Statistics	4	3.74	1.00	93.5
224	The ability to identify non-wetland and wetland soil types by soil characteristics, soil maps, and imagery.	Physical Science	4	3.71	0.82	96.7
225	To have basic camping and outdoor survival skills.	Practical Daily Skills	4	3.71	0.94	93.5
226	To have knowledge of the life history requirements for various migratory birds.	Biological Sciences	4	3.68	0.65	100
227	The ability to implement and assess prescribed fire for habitat restoration and management.	Biological Sciences	4	3.68	0.70	100
228	The ability to understand the various roles and responsibilities of federal and state government at the executive, legislative, and	Policy Administra-tion	4	3.68	0.75	100

(Table cont.)

	judicial levels.					
229	The ability to implement and complete biodiversity assessments.	Quantita-tive Science	4	3.68	0.75	96.7
230	To develop critical quantitative thinking skills by completing math courses through college calculus.	Quantita-tive Science	4	3.68	0.87	93.
231	To develop critical quantitative thinking skills by completing math courses through college trigonometry.	Quantita-tive Science	4	3.68	0.94	96.7
232	The ability to edit and critically review communication media (manuscripts and presentations).	Communi-cations	4	3.65	0.66	100
233	The ability to trap wildlife.	Biological Sciences	4	3.65	0.80	96.7
234	To have knowledge of spatial and temporal landscape analysis.	Quantita-tive Science	4	3.65	0.88	93.5
235	To have knowledge of different types of hunting equipment.	Practical Daily Skills	4	3.65	0.98	87.1
236	The ability to apply basic budgeting and accounting skills in the workplace.	Policy Administra-tion	4	3.61	0.67	100
237	The ability to identify the pertinent factors which affect a transect sampling route.	Quantita-tive Science	4	3.61	0.76	96.7
238	To be knowledgeable of white-tailed deer management techniques.	Biological Sciences	4	3.58	0.76	93.5
239	The ability to key-out vertebrate species.	Biological Sciences	3	3.58	0.76	87.1
240	To recognize and understand the relationship between climate and ecosystems.	Physical Science	4	3.58	0.81	93.5
241	The ability to implement population-adaptive harvest management techniques.	Basic Statistics	4	3.58	0.89	90.3
242	The ability to identify, classify, and compare plant communities by implementing plant surveying and mapping techniques (e.g. Daubenmire habitat method).	Biological Sciences	4	3.55	0.57	100
243	To have knowledge of forest management with emphasis on hardwood management.	Biological Sciences	3	3.55	0.72	90.3

(Table cont.)

244	To have knowledge of the life history requirements for waterfowl.	Biological Sciences	4	3.55	0.77	93.5
245	The ability to locate and identify potential employment opportunities.	Practical Daily Skills	4	3.55	0.81	96.7
246	The ability to operate an ATV as indicated by training certification.	Practical Daily Skills	4	3.55	1.12	80.6
247	The ability to understand the assumptions of parametric and non-parametric statistics.	Basic Statistics	3	3.52	0.68	93.5
248	The ability to understand and apply human social, demographic, economic, and political implications as related to wildlife law, sustainable resources, management, harvest, conservation, preservation, and assessment.	Humanities	3	3.52	0.77	90.3
249	To be familiar with global historic and contemporary wildlife issues.	Humanities	3	3.48	0.51	100
250	To understand the relationship between soil type, soil fertility, soil hydrology, and plant community to assess ecosystem cycling, productivity, and distribution.	Physical Science	3	3.48	0.81	90.3
251	The ability to estimate animal populations by ground transects.	Quantita-tive Sciences	3	3.42	0.76	93.5
252	To know the agencies and CEOs that affect state and federal wildlife programs.	Policy Administra-tion	3	3.42	0.85	90.3
253	The ability to implement water level management strategies for habitat restoration and management.	Biological Sciences	3	3.42	0.89	90.3
254	The ability to identify all plants and plant communities within a sampling point.	Quantita-tive Sciences	3	3.39	0.62	100
255	The ability to follow basic laboratory procedures.	Practical Daily Skills	3	3.39	0.67	96.7
256	To have knowledge of coniferous ecosystems.	Biological Sciences	3	3.39	0.72	96.7

(Table cont.)

257	The ability to statistically analyze population data to determine population growth and recruitment potential.	Basic Statistics	3	3.39	0.76	93.5
258	The ability to use timber inventory sampling techniques that are commonly used in modern forest management.	Quantita-tive Sciences	3	3.39	0.80	93.5
259	The ability to understand diverse wildlife values and use that information to design and implement environmental education and/or outreach programs.	Humanities	3	3.39	0.80	90.3
260	The ability to key-out a mammal species.	Biological Sciences	3	3.39	0.88	90.3
261	The ability to plan, implement, and assess the findings of random transect sampling.	Quantita-tive Sciences	3	3.35	0.71	93.5
262	To understand and recognize the relationships between geology and ecosystems of the work area, district and region.	Physical Science	3	3.35	0.84	90.3
263	To have knowledge of political science.	Humanities	3	3.35	0.84	90.3
264	To understand the relationships between geography and ecosystems.	Physical Science	3	3.35	0.88	90.3
265	The ability implement risk assessments for "species at risk."	Quantita-tive Sciences	3	3.32	0.60	96.7
266	The ability to identify, sex, and age neotropical birds.	Biological Sciences	3	3.32	0.70	96.7
267	The ability to plan, implement, and assess the findings of a point-center plot survey.	Quantita-tive Sciences	3	3.32	0.70	96.7
268	The ability to plan, implement, and assess the findings of a plot transect survey.	Quantita-tive Sciences	3	3.32	0.70	96.7
269	The ability to understand historical and contemporary roles of society in forest management.	Humanities	3	3.32	0.75	96.7
270	To have knowledge of wildlife damage management principles.	Biological Sciences	3	3.32	0.98	90.3

(Table cont.)

271	To have knowledge of the factors affecting plant growth, reproduction, fitness, and survival including knowledge of diseases and genetics.	Biological Sciences	3	3.29	0.69	100
272	The ability to plan, implement, and assess a belt-line transect sampling design.	Quantita-tive Sciences	3	3.29	0.69	96.7
273	The ability to conduct waterfowl surveys utilizing current technology.	Quantita-tive Sciences	3	3.29	0.69	96.7
274	The ability to use, develop, or adapt habitat suitability index models to estimate habitat quality and potential.	Quantita-tive Sciences	3	3.29	0.78	96.7
275	To be familiar with various radio telemetry techniques.	Quantita-tive Sciences	3	3.29	0.86	93.5
276	The ability to apply macro and microeconomics concepts to wildlife management.	Humanities	3	3.26	0.58	100
277	The ability to implement survey techniques for migratory neotropical birds.	Biological Sciences	3	3.26	0.63	100
278	The ability to conduct deer surveys using current technology.	Quantita-tive Sciences	3	3.26	0.82	93.5
279	To have an understanding of range ecology and management principles.	Biological Sciences	3	3.26	0.89	90.3
280	The ability to age various wildlife species by locating and implementing species-specific techniques.	Biological Sciences	3	3.23	0.72	100
281	The ability to perform routine service and emergency repair of vehicles and equipment.	Practical Daily Skills	3	3.23	0.76	96.7
282	The ability to apply basic knowledge of business administration and management in the workplace.	Policy Administra-tion	3	3.23	0.76	93.5
283	To have basic knowledge of mammalian reproductive physiology.	Biological Sciences	3	3.23	0.80	100
284	To have knowledge of basic water quality monitoring techniques.	Physical Science	3	3.23	0.80	93.5

(Table cont.)

285	To have knowledge of basic water quality monitoring techniques.	Physical Science	3	3.23	0.80	93.5
285	The ability to estimate animal populations by aerial transects.	Quantita-tive Sciences	3	3.23	0.80	93.5
286	The ability to use soil type and topography to assess the hydrologic regime.	Physical Sciences	3	3.23	0.84	96.7
287	To recognize and understand the relationship between regionalized weather patterns (daily, seasonal, and long-term patterns) and weather impacts on wildlife.	Physical Sciences	3	3.23	0.84	96.7
288	The ability to plan, implement, and assess the findings of a browse survey.	Quantita-tive Sciences	3	3.23	0.84	96.7
289	The ability to identify animal sign for animal damage control assessment.	Biological Sciences	3	3.23	0.88	96.7
290	To have basic knowledge of avian reproductive physiology.	Biological Sciences	3	3.23	0.92	93.5
291	The ability to implement and manage moist soil unit plant productivity.	Physical Sciences	3	3.23	0.99	87.1
292	To have a basic knowledge of herpetology.	Biological Sciences	3	3.19	0.48	100
293	To have knowledge of fish biology and management.	Biological Sciences	3	3.19	0.87	93.5
294	The ability to speak with the media and get your most important message across in a 30 second sound bite.	Communi-cations	3	3.19	0.95	90.3
295	To be first aid and CPR qualified.	Practical Daily Skills	3	3.19	0.98	87.1
296	The ability to manage the soil for improved environmental and economic productivity.	Physical Science	3	3.16	0.69	96.7
297	To have basic knowledge in law enforcement and the wildlife agent's duties.	Policy Administra-tion	3	3.16	0.78	93.5
298	The ability to plan, implement, and assess the findings of a public opinion survey (questionnaires).	Quantita-tive Sciences	3	3.16	0.82	100

(Table cont.)

299	The ability to implement survey techniques for members of the Cervidae family.	Biological Sciences	3	3.16	0.86	96.7
300	To recognize and understand the relationship between elevation and ecosystem diversity.	Physical Sciences	3	3.16	0.86	96.7
301	The ability to implement waterfowl surveys.	Biological Sciences	3	3.16	0.90	96.7
302	To have basic knowledge and use of various farm equipment and implements.	Practical Daily Skills	3	3.16	0.90	93.5
303	The ability to document information via camera operation.	Practical Daily Skills	3	3.16	0.90	93.5
304	To have a practical understanding of meteorology.	Physical Sciences	3	3.16	0.93	93.5
305	The ability to effectively manage relationships with lessees (e.g. hunting clubs).	Practical Daily Skills	3	3.16	0.93	90.3
306	The ability to operate hand-held computers.	Practical Daily Skills	3	3.13	0.72	100
307	The ability to identify soil types and characteristics within a sampling point.	Quantita-tive Sciences	3	3.13	0.76	96.7
308	The ability to effectively manage prescribed fire to protect air quality.	Physical Sciences	3	3.13	0.81	96.7
309	To have basic knowledge and basic abilities to use hand tools for carpentry, electrical, plumbing, metal fabrication, and general maintenance.	Practical Daily Skills	3	3.13	0.81	96.7
310	The ability to understand the basics of fire and fire fighting (wildland fire training/certification: Federal s130/190).	Practical Daily Skills	3	3.13	0.81	96.7
311	To have basic knowledge of mammalian anatomy.	Biological Sciences	3	3.10	0.75	96.7
312	The ability to use surface soils, sub-surface soils, and topography information to assess surface water retention, ground water components, and hydrologic cycles for wildlife management planning.	Physical Sciences	3	3.10	0.79	96.7

(Table cont.)

313	To have knowledge of grassland/rangeland inventory techniques.	Quantitative Sciences	3	3.10	0.83	96.7
314	The ability to map and inventory a watershed.	Physical Sciences	3	3.10	0.87	90.3
315	The ability to use a winch on a vehicle.	Practical Daily Skills	3	3.10	0.87	90.3
316	To have knowledge of major case histories involving controversial resource issues such as the Monogahela decision, Everglades, Columbia River dams, Chesapeake Bay pesticides, Northwest old growth forests and Northwest Forest Plan by the Clinton Administration.	Policy Administration	3	3.10	0.94	93.5
317	To be able to read and understand reports that utilize advanced statistical concepts (ANCOVA, Logistic Regression, etc.)	Basic Statistics	3	3.10	0.94	90.3
318	The ability to manage greentree and moist soil units for target species and species diversity.	Biological Sciences	3	3.10	0.98	90.3
319	To have knowledge of the effects of disease on wildlife growth, reproduction, fitness, and survival.	Biological Sciences	3	3.06	0.68	100
320	To understand the basic principles of plant physiology.	Biological Sciences	3	3.06	0.77	96.7
321	To have basic knowledge of water rights law.	Policy Administration	3	3.06	0.77	96.7
322	The ability to age deer by dental wear.	Biological Sciences	3	3.06	0.96	93.5
323	The ability to identify, locate, implement, and assess site-specific controls for non-point source pollution to improve water quality.	Physical Sciences	3	3.06	0.96	90.3
324	To have knowledge of shorebird life history.	Biological Sciences	3	3.03	0.84	100
325	To have knowledge of silvicultural biometrics.	Quantitative Sciences	3	3.00	0.82	96.7
326	The ability to formulate public use regulations.	Policy Administration	3	3.00	0.82	96.7

(Table cont.)

327	To have knowledge of shorebird management techniques.	Biological Sciences	3	3.00	0.93	96.7
328	The ability to operate a motorized boat as indicated by training certification.	Practical Daily Skills	3	3.00	0.93	96.7
329	To have basic knowledge of avian anatomy.	Biological Sciences	3	2.97	0.71	96.7
330	The ability to conduct shorebird surveys using current technology.	Quantita-tive Sciences	3	2.97	0.80	100
331	To have knowledge of different types of fishing equipment.	Practical Daily Skills	3	2.97	0.84	96.7
332	The ability to apply classification and ordination statistics to determine ecological groupings and gradients.	Quantita-tive Sciences	3	2.97	0.87	93.5
333	To have knowledge of the effects of genetics on wildlife growth, reproduction, fitness, and survival.	Biological Sciences	3	2.94	0.63	100
334	The ability to apply wildfire risk assessment models to "species at risk."	Physical Sciences	3	2.94	0.81	100
335	The ability to understand a soil analysis and determine fertilizer and lime recommendations.	Physical Sciences	3	2.94	0.85	96.7
336	The ability to determine and identify species-specific agricultural depredation potentials.	Biological Sciences	3	2.94	0.85	93.5
337	The ability to communicate by radio.	Practical Daily Skills	3	2.94	0.89	93.5
338	The ability to identify, locate, implement, and assess site-specific controls for non-point source pollution to improve water quality.	Physical Sciences	3	2.94	0.93	90.3
339	The ability to use basic land surveying techniques (e.g. shooting elevations, determining boundaries, setting grade, road construction, logging systems).	Quantita-tive Sciences	3	2.94	1.06	90.3
340	To have knowledge of water chemistry and water quality sampling methods.	Physical Sciences	3	2.90	0.83	96.7
341	The ability to understand risk analysis and management.	Policy Administra-	3	2.90	0.83	93.5

(Table cont.)

		tion				
342	To be able to read and understand complex research designs.	Basic Statistics	3	2.90	0.87	96.7
343	The ability to key-out invertebrate species.	Biological Sciences	3	2.90	0.98	93.5
344	To be defensive driving certified.	Practical Daily Skills	3	2.90	1.11	83.8
345	The ability to write grants.	Communi-cations	3	2.87	0.72	100
346	The ability to implement survey techniques for shorebirds.	Biological Sciences	3	2.87	0.85	100
347	To develop critical quantitative thinking skills by completing college physics.	Quantita-tive Sciences	3	2.87	0.92	96.7
348	To have basic knowledge of mammalian physiology.	Biological Sciences	3	2.84	0.64	100
349	To have a basic knowledge of physical and organic chemistry to aid with chemical applications (fertilizer, herbicides, and pesticides).	Physical Sciences	3	2.84	0.78	100
350	The ability to implement a species-specific population viability analysis.	Quantita-tive Science	3	2.84	0.82	96.7
351	To have the basic knowledge of organic chemistry.	Physical Sciences	3	2.84	0.86	93.5
352	The ability to reference legal codes that provide the mandate for agency administration and operation.	Policy Administra-tion	3	2.84	0.93	96.7
353	The ability to safely operate a chainsaw and properly fell a tree.	Practical Daily Skills	3	2.84	0.93	93.5
354	To have basic knowledge of construction.	Practical Daily Skills	3	2.84	0.93	90.3
355	To have an understanding of modern genetic approaches in wildlife conservation.	Biological Sciences	3	2.81	0.60	100
356	To be familiar with SAS (Statistical Analysis System).	Basic Statistics	3	2.81	0.75	96.7
357	The ability to identify signs and symptoms of common wildlife diseases.	Biological Sciences	3	2.81	0.79	100
358	The ability to determine the suitability of land for agronomic production.	Physical Sciences	3	2.81	0.83	100

(Table cont.)

359	The ability to read and follow blueprints and shop drawings.	Practical Daily Skills	3	2.81	0.83	93.5
360	To have basic knowledge of the taxonomy of spermatophytes.	Biological Sciences	3	2.81	0.91	96.7
361	To have basic knowledge of avian physiology.	Biological Sciences	3	2.77	0.62	100
362	To have the basic knowledge of inorganic chemistry.	Physical Science	3	2.74	0.89	93.5
363	To have a basic knowledge of entomology with emphasis in aquatic insects and tree damaging pathogens.	Biological Sciences	3	2.71	0.59	100
364	The ability to conduct mourning dove surveys using current technology.	Quantita-tive Sciences	3	2.71	0.86	93.5
365	The ability to perform basic necropsy procedures and protocol, which include sample collection and tissue storage.	Biological Sciences	3	2.65	0.80	93.5
366	The ability to conduct woodcock surveys using current technology.	Quantita-tive Sciences	3	2.65	0.84	93.5
367	The ability to conduct rail surveys using current technology.	Quantita-tive Sciences	3	2.65	0.84	93.5
368	The ability to administer proper animal care through animal husbandry techniques and contemporary knowledge of animal welfare issues.	Biological Sciences	2	2.65	1.08	87.1
369	The ability to monitor water quality using direct and remote automated equipment for wildlife management planning.	Physical Sciences	3	2.61	0.92	87.1
370	The ability to use inferential statistics to estimate home range.	Basic Statistics	2	2.58	0.81	90.3
371	The ability to use basic meteorological monitoring equipment and apply meteorological data for wildlife management planning.	Physical Sciences	2	2.52	0.85	90.3
372	To have knowledge of agrostology for the study of grasses and grassland habitat management.	Biological Sciences	2	2.45	0.57	100

(Table cont.)

373	To have knowledge of organic and biochemistry with specific information on toxicology and environmental health.	Physical Sciences	2	2.45	0.72	93.5
374	The ability to monitor and interpret basic soil and water models to estimate sediment yield, water quality, and water heating.	Physical Sciences	2	2.35	0.84	93.5
375	To have basic knowledge and use of heavy equipment.	Practical Daily Skills	2	2.35	0.91	90.3
376	To have knowledge of animal evolution, which includes ecological, genetic and molecular techniques.	Biological Sciences	2	2.32	0.83	93.5
377	The ability to implement variable-plot tree cruising using a Relaskop instrument.	Quantita-tive Science	2	2.29	0.74	100
378	To have basic knowledge of business law.	Policy Administra-tion	2	2.29	0.90	93.5
379	The ability to assess and implement irrigation techniques for land use.	Physical Sciences	2	2.26	0.93	90.3
380	The basic ability for repair and maintenance of computers (troubleshooting for repair and maintenance).	Practical Daily Skills	2	2.19	0.75	100
381	To have knowledge of plant evolution, which includes ecological, genetic and molecular techniques.	Biological Sciences	2	2.16	0.73	100
382	To have experience in small aircraft and helicopters	Practical Daily Skills	2	2.13	0.72	100
383	To have experience in fish shocking equipment.	Practical Daily Skills	2	1.97	0.75	100
384	To have experience with wetsuits/snorkeling.	Practical Daily Skills	2	1.84	0.73	100
385	The ability to fabricate metal (welding/cutting operations).	Practical Daily Skills	2	1.77	0.76	100

Note. Mean ratings were classified according to the following interpretive scale: 5.00 – 4.50 = high importance; 4.49 – 3.50 = substantial importance; 3.49 – 2.50 = moderate importance; 2.49 – 1.50 = low importance; and 1.49 – 1.00 = no importance.
[a]Job skill area = curriculum content area as defined by The Wildlife Society (TWS) plus practical daily work skills.
[b]Median of ratings assigned by Delphi Panelists.

(Table cont.)

[c]Mean rating based on following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.
[d]Level of consensus = percentage of responding panelists within $\pm$ 1 of the median.

Summary of Quantitative Results

Thirty-one, 32, and 31 panel members responded in Rounds One, Two, and Three, respectively. Round One responses produced 1,082 potential entry-level job skill items that were consolidated to 382 unique items. Round Two responses added two new items by one panelist. Round Three responses indicated consensus on all 384 items, and the level of consensus among all items ranged from 80.6% to 100%.

All entry-level job skill items were categorized by level of importance rating and by area (Table 26). The hard sciences (biology, quantitative, physical, and statistics) accounted for 219 of the 384 items with biology accounting for 108 of the hard science items. The soft sciences (communication, policy administration, and humanities) accounted for 111 of 384 items with communication accounting for 42 of 111 soft science items. Practical daily skills accounted for 54 of 384 items.

When the items were grouped according to importance rating, 72 were of high importance, 175 were of substantial importance, 123 were of moderate importance, 14 were of low importance, and zero were of no importance. In descending order, the number of skills by area were biological sciences (108), practical daily work skills (54), quantitative sciences (49), communication (42), policy administration (38), physical science (35), humanities (31), and basic statistics (27).

Table 26. Summarized Entry-level Job Skills Needed by Wildlife Management Professionals by Importance Rating and Job Skill Areas as Perceived by Wildlife Management Experts in Third Round of a Delphi Survey.

Job Skill Area	High Importance 5.00 - 4.50	Substantial Importance 4.49 - 3.50	Moderate Importance 3.49 - 2.50	Low Importance 2.49 - 1.50	Total
Biological Sciences	13	56	36	3	108
Practical	15	16	17	6	54
Quantitative Sciences	4	18	26	1	49
Communication	25	15	2	0	42
Policy Administration	3	26	8	1	38
Physical Sciences	0	8	24	3	35
Humanities	7	19	5	0	31
Basic Statistics	5	17	5	0	27
Total	72	175	123	14	384
Percent Frequency	18.75	45.57	32.03	3.65	100

Delphi Panelist Comments

Delphi panelists provided several comments both embedded within the survey instrument and in other communications (email responses). A complete listing of all comments is provided in Appendix V. When the comments provided by the study participants were examined, the participants seemed to focus on one of three themes. The comments were summarized by the researcher within each of these themes, which were labeled by the researcher as management issues, item redundancy, and study importance.

Management Issues.--Response rates varied for each survey round, which seemed to be related primarily to individual workplace needs of the panelists. As a result, time extensions were allotted during each survey round for panelists to complete the survey instruments. Several panelists expressed appreciation for these extensions that allowed them to complete the surveys within the time permitted by their work venue. Examples of these comments include: “Sorry for the delay. I have been out of the office for two weeks;” Sorry about the delay – other imposed priorities prevented a more rapid response;” and “Billy, Thanks for the extension. I was able to get to the survey now. Sorry for the delay.”

Item Redundancy.--In the Round Two letter of instruction and instrument, panelists were requested to rate each item independently regardless if any items appeared to be redundant. However, two panelists expressed concerns about redundancy in the items.

One panelist indicated that “I did not have the time when so many are the same.” The researcher replied to the panelist and explained that the redundancy was to protect the potential uniqueness of all items. The panelist subsequently completed the instrument.

Another panelist dealt with the redundancy issue differently. If an item appeared to be redundant, he or she gave the item(s) a lower rating than the previous similar item. However, upon receiving the Round Three instrument, the panelist re-rated each item independently, and responded, “…Job has been completed. As I went back through the surveys, I again noted that most of my low ratings in the second round were because of what I interpreted to be redundancy. …Apparently, others didn't agree. So, I went back and considered each item independently of all other responses, and ended up changing most. Hope this helps some.”

Study Importance.--Several of the comments provided throughout the study dealt with the importance of the research. Generally, these took the form of expressions of appreciation for conducting an important study and for the opportunity to serve on the panel.

Three examples of these comments include: “Professor Delany ... A well-designed survey to facilitate input to better develop curricula for future wildlife managers ... interesting in that I surprised even myself at the high importance I placed on the "people" side of our business ... thanks for giving me the opportunity to participate ...;” “Good luck with your endeavor to improve the college course work for this field. Hope my participation was helpful;" and "…I am interested in the final report. Good luck."

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

Purpose.-- The primary purpose of this study was to identify the job skills needed by entry-level wildlife managers. The study objective was accomplished by utilizing a Delphi panel of wildlife management experts from the academic, private and public employment sectors. These experts were asked to respond to the focus question "What are the job skills needed by entry-level wildlife managers?" in each of the seven areas identified by The Wildlife Society for biologist certification plus the additional area of "practical daily work skills."

Methodology.--The target population for this Delphi study was defined as wildlife managers currently employed in professional positions that are innovative and forward thinking regarding their approach to wildlife management. The Delphi panel was selected from a pool of 81 wildlife management professionals nominated by their peers as meeting the criteria of innovative and forward thinking experts. The panel for Rounds One, Two, and Three consisted of 31, 32, and 31 respondents, respectively. The Round One panel was composed of 10 academic, 10 private, and 11 public sector members. The Round Two panel was composed of nine academic, 11 private, and 12 public sector members. The Round Three panel was composed of nine academic, 10 private, and 12 public sector members.

A unique survey instrument was developed for Rounds One, Two, and Three, respectively. The Round One survey instrument utilized the study focus question and requested that panelists respond for each of the eight identified job skill areas (biological sciences, physical sciences, basic statistics, quantitative sciences, humanities, communication, policy administration, and practical daily work skills). The Round Two survey instrument was the compiled unique items of the Round One results for each of the eight job skill areas. In the

Round Two instrument, the panelists rated each item on the following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance. The Round Three instrument was unique to each panelist. The Round Three instrument contained the group rating and the panelist's unique rating for each item. Each panelist was requested to review his or her unique instrument and for each item not in consensus (highlighted in yellow), the panelist was requested to re-rate the items within ± 1 of the group median or provide their reasoning for maintaining their present rating not in consensus.

Findings

The objective of the study was accomplished by identifying the job skills needed by entry-level wildlife managers as perceived by a Delphi panel of wildlife management experts. To identify the job skills, the Delphi panel participated in three Delphi survey rounds. The Round One survey identified 382 unique entry-level job skill items. The Round Two survey developed initial ratings on the 382 items and provided two more items for the panel's consideration. The Round Three survey established consensus on 384 entry-level job skill items.

Round One.--The Round One instrument utilized the eight job skill areas to construct eight sub-instruments (biological sciences, physical sciences, basic statistics, quantitative sciences, humanities, communications, policy administration, and practical daily work skills), which resulted in 1,082 entry-level job skill items. The job skill items were reduced to 382 unique entry-level job skill items to develop the Round Two instrument.

Round Two.--In Round Two, the eight sub-instruments were utilized to collect the initial ratings on the 382 entry-level job skill items identified by the Round One instrument. Because of one panelist's perception, two entry-level job skill items were added to the list. These items were biological sciences # 108 and practical daily work skills # 54. Two items were tied for the number one rating with a mean of 4.94 (SD = 0.25), which were "to have a strong foundation in wildlife management principles and techniques" and "the ability to be an ethical wildlife manager." The lowest rated item "the ability to fabricate metal (welding/cutting operations)" had a mean of 1.81(SD = 0.82). Overall 54 items were rated as "high importance" (5.00 – 4.50); 196 items were rated as "substantial importance" (4.49 – 3.50); 122 items were rated as "moderate importance" (3.49 – 2.50); 11 items were rated as "low importance" (2.49 – 1.50), and no items were rated as no importance (1.49 – 1.00).

Round Three.--In Round Three, each panel member was requested to review those items in which his or her ratings were not within one rating scale point of the group median. If a panelist's rating was not within one point of the group median, the panel member was requested to re-rate the item within one point or maintain their previous rating and provide a brief explanation for their differing opinion.

The results of Round Three indicated consensus on all 384 items. Level of consensus among all 384 items ranged from 80.6% to 100%..

The final ranking of entry-level job skills was completed by sorting the items by descending means, ascending standard deviation, and descending percent consensus. All entry-level job skill items were then grouped into levels of importance and by academic concentration categories. When the items were grouped according to importance rating, 72 were rated of "high importance," 175 were rated of "substantially importance," 123 were rated of "moderate importance," 14 were rated of "low importance," and zero were rated of "no importance." The number of skills by job skill area was biological sciences (108), practical daily work skills (54), quantitative sciences (49), communication (42), policy administration (38), physical science (35), humanities (31), and basic statistics (27).

The items which received the highest mean rating of importance for each of the eight job skill areas is listed below in ranked order by Overall Ranking, Median, Mean, Standard

Deviation (SD), and Level of Consensus.

1. Biological - To have a strong foundation in wildlife management principles and techniques (Median of 5, Mean of 4.97, SD = 0.18, and Level of Consensus = 100%).
2. Practical Daily - The ability to be an ethical wildlife manager (Median of 5, Mean of 4.94, SD = 0.25, and Level of Consensus 100%).
3. Quantitative Sciences - The ability to accurately measure and record data (Median of 5, Mean of 4.90, SD = 0.30, and Level of Consensus = 100%).
4. Communications - The ability to write a simple technical report (Median of 5, Mean of 4.90, SD = 0.30, and Level of Consensus = 100%).
5. Policy Administration - The ability to work within existing laws, regulations, and policies (Median of 5, Mean of 4.84, SD = 0.37, and Level of Consensus = 100%).
6. Humanities - The ability to develop personal environmental ethics and resource philosophy (Median of 5, Mean of 4.81, SD of 0.40, and Level of Consensus = 100%).
7. Basic Statistics - To understand the application of statistics to wildlife management and research (Median of 5, Mean of 4.71, SD = 0.46, and Level of Consensus = 100%).
8. Physical Science - The ability to use plant community indices to determine wildlife habitat value (Median of 4, Mean of 4.23, SD = 0.67, and Level of Consensus = 100%).

The Delphi panelist’s comments were summarized in three groupings: management issues, item redundancy, and study importance. Time extensions were given to non-respondent panelists, which allowed for the collection of a more complete database. Redundancy issues were explained as a Delphi methodology to maintain the unique contributions of any panelist. Panelist often concluded their responses with an appreciation to participate in this Delphi study and indicated the value of this research for undergraduate curriculum development.

Conclusions and Recommendations

The following conclusions and implications were derived from the findings of the study:

1. Job skills needed by entry-level wildlife managers are identifiable. This conclusion is based on the following findings of the study: (1) a total of 384 unique entry-level job skills were identified by members of a Delphi panel of innovative professional wildlife management experts; (2) the 384 identified skills were rated regarding their importance to job success with importance mean ratings ranging from 4.97 to 1.77; and (3) the members of the Delphi panel reached consensus (51% rated the item $\pm$ 1 point of the median rating) on all 384 items. This conclusion is consistent with the existing literature regarding the use of the Delphi technique for identification of content in specific areas, especially as related to curriculum development issues (Linstone and Turoff 2002). Linstone and Turoff (2002) suggested the Delphi technique is particularly appropriate when identifying the specific needs of a unique phenomenon such as the case of entry-level job skills of wildlife managers. This conclusion is consistent with the results of the study completed by Gaspard (1992) in which the concepts needed in a plant science curriculum were identified and achieved consensus.

Based on this conclusion and these findings, the researcher recommends that faculty in Bachelor of Science wildlife management programs use the prioritized listing of wildlife management entry-level job skills as the basis for evaluating their undergraduate curriculum. In addition, the researcher recommends that curricula be revised and updated to include all entry-level job skills which received ratings of “substantial importance” or higher. This may be accomplished in a number of ways including revising current courses, inclusion of new courses (with corresponding elimination of non-critical courses), and the addition of experiential learning.

2. Entry-level job skills needed by wildlife managers are diverse. This conclusion is based on the diversity of “high importance” and “substantial importance” entry-level job skill items. Of the 72 “high importance” entry-level job skills items, the “hard sciences” (biology, quantitative, physical, and statistics), “soft sciences” (communication, policy administration, and humanities), and practical daily skills accounted for 22, 35, and 15 items, respectively. Of the 175 “substantial importance” entry-level job skill items, the “hard sciences,” “soft sciences,” and practical daily skills accounted for 99, 60, and 19 items, respectively. These results indicate an emphasis on three generalized areas of “hard science,” “soft science,” and practical daily job skills in preparing individuals for entry-level careers in wildlife management. Leopold (1931), Graham et al. (1945), and Cottam (1947) indicated that the wildlife curriculum should include diverse knowledge from varied scientific, academic, and practical applications (i.e. agronomy, biology, biometrics, communications, ecology, economics, engineering, forestry, leadership, soils, and watersheds). Leonard (1955), Schoenfield (1957), and Lumsden (1957) indicated the need to understand the human demands placed on wildlife. Furthermore, the research results of this study are comparable to Peek’s (1989) recommendation of a diverse and flexible wildlife management curriculum that includes biology, ecology, planning, statistics, research techniques, and sociology. Knight (1996) suggested that universities should include courses in environmental ethics, ecological restoration, landscape ecology, human dimensions, and conservation biology.

Based on this conclusion and these findings, the researcher recommends that faculty in Wildlife Management programs in higher education evaluate their current curricula to determine the extent to which the needed diversity exists in the preparation provided to enrolled students. In addition, the researcher recommends that when deficiencies are identified in the diversity of the curriculum that revisions be incorporated to reflect the identified needed job skills as found in this study.

3. Biological job skills comprise the most important job skills for entry-level wildlife managers. This conclusion is based upon the results that biological sciences had the most entry-level job skill items rated as "high to substantial importance" (69 of 247) and overall (108 of 384). Early in the development of the wildlife profession, Leopold (1931) indicated that the wildlife professional must have an ecological aptitude and a willing ability to apply pure and applied biology. Graham et al. (1945) stated that the "best man" has the widest knowledge and abilities, and that managers should be multi-talented in taxonomy, ecology, wildlife techniques, regulatory issues, economics, and human elements. Today, this biological knowledge is necessary for biological certification through The Wildlife Society, which requires 36 hours of biological science including biology, botany, ecology, wildlife management, and zoology (Yoakum and Zagata 1982, The Wildlife Society 2003).

Based on this conclusion and these findings, the researcher recommends that the "Biological Sciences" job skills be placed in highest priority when making curricular decisions for wildlife management programs. This is especially true for those skills that were rated as "high importance" and "substantial importance" by the members of the Delphi panel in this study.

4. Communication entry-level job skills are highly important to entry-level wildlife managers. This conclusion is based on the number of communication items that were rated "high importance" as compared to all "high importance" job skill areas. Of the 72 entry-level job skills identified as "high importance," 25 were communication entry-level job skills. Cottam (1947) indicated that a criticism of wildlife managers was poor communication skills. Currently in the wildlife profession, communication skills are recognized professional needs (Peek 1989,

Jensen et al. 1998, Thomas 2000). Entry-level communication job skills also involve the ability to communicate successfully for collaborative problem solving (Day and Koorland 1997, Lee and Blaszcznski 1999, Paulson 2001). Finally, wildlife management has been described as 90% people management and 10% wildlife management (Lumsden 1957, Thomas 2000).

Based on this conclusion and these findings, the researcher recommends that the "Communications" job skills be given a high level of priority when making curricular decisions for wildlife management programs. In addition, the researcher recommends that evaluative studies be conducted of wildlife program graduates to ascertain the current level of communication skills being developed and additional studies be conducted after curricular revisions to determine the effectiveness of the changes made in the curriculum in preparing graduates with needed communication skills.

5. Practical daily entry-level job skills are of "high to substantial importance" to entry-level wildlife managers. This conclusion is based on the findings that practical daily work entry-level job skills had the third highest number of job skills rated as "high importance" and "substantial importance" (31 of 247). Graham et al. (1945) stated that the "best man" has the widest knowledge and abilities, and that managers should be multi-talented in taxonomy, ecology, wildlife techniques, regulatory issues, economics, and human elements. Bailey (1982) suggested that wildlife biologists must creatively apply the scientific method to obtain meaningful results for making value judgments during management processes. Gould (2001:1022) stated, "Today's students are tomorrow's future," and as the wildlife profession entered the 21st century, field biologists have become wildlife-ecological scientists, problem solvers, data collectors, good scientists, and skilled workers.

Based on this conclusion and these findings, the researcher recommends that the "practical daily" job skills be given a high level of priority when making curricular decisions for wildlife management programs. These skills would be most likely developed in the curriculum through required laboratory, field, and experiential learning activities incorporated into the wildlife management program.

6. Policy administration entry-level job skills are of “high to substantial importance” to entry-level wildlife managers. This conclusion is based on the findings that 29 of 38 policy administration entry-level job skills were rated as “high importance” and “substantial importance.” Graham et al. (1945) indicated that the talents of a wildlife manager should include the ability to administer laws, understand economics, and appreciate the role of human elements. Brown and Nielson (2000) discussed the need that new graduates should have college-learned skills, which include personnel management, budgeting, and conflict resolution. Paulson (2001) theorized that premium job skills include the ability to understand organizational and contextual issues, budgetary management, foreign language communication, globalism, multicultural understanding, negotiation, project management, and systems thinking.

Based on this conclusion and these findings, the researcher recommends that the “Policy Administration” job skills be given a high level of priority when making curricular decisions for wildlife management programs. These skills would be most likely developed in the curriculum through the integration of accounting, economics, leadership, and management courses into the wildlife management curriculum.

7. A substantial amount of redundancy exists in the job skills identified and rated in the study. This conclusion is based on the following findings of the study: (1) considerable redundancy was observed by the researcher throughout three rounds of the Delphi. However, as previously indicated, the uniqueness of items was preserved as a precaution to maintain the integrity of any unique contribution from panelists who participated in the study and (2) redundancy was noted in both written and verbal communication with the researcher by several

members of the panel. This conclusion is exemplified by biological items 3, 5, and 9: "To have a sound understanding of ecological principles and concepts of the relationships between plants, animals, and the environment"; "To have a sound foundation in wildlife ecological principles and processes"; and "To have a basic understanding of ecology, population, community, and ecosystem."

Based on these conclusions and findings, the researcher recommends further research to reduce the number of items to a practical list of entry-level job skills that can be used as a guide for curriculum development. To reduce the number of items, an expert panel of wildlife management experts could be formed to render the items into a workable list for curriculum development and planning. The Q-sort technique could be utilized to assist the expert panel with the task of consolidating the items. The expert panel members could include the Delphi panel members who indicated item redundancy in the survey instruments.

8. The Delphi panel of wildlife management experts provided valid and reliable guidance to develop a list of entry-level job skills needed by wildlife management professionals. This conclusion is the result of the Delphi panel's consensus on all 384 entry-level job skill items identified in this study. In agreement with other wildlife professionals, this research identified profession-specific knowledge and skills in the areas of biology, botany, ecology, statistics, and zoology (Leopold 1931, Yoakkum and Zagata 1982, Adelman et al. 1994, Jensen et. al. 1998, Brown and Nielson 2000, Organ and Fritzell 2000, Burger and Leopold 2001, Johnson et al. 2001, Winterstein et al. 2001, and Kendal and Gould 2002). Additionally, this research identified futuristic work skills common to modern industry (i.e. analytical, communication, technology, critical thinking, and personal development) (Lee and Blaszcznski 1999, Hansen 2001, Westera 2001, Paulson 2001, and Dodd et al. 2002). However, the reader should be aware that the possibility exists that job skills may have been overlooked by the panel in this study.

This is because virtually all of the panelists were in administrative/supervisory/management positions rather than primarily field positions. In addition, certain skills, especially those that are technology related may not have been identified by this panel due to the extensive years of experience and the corresponding time at which they entered the profession themselves. A panel that includes younger wildlife management experts who are currently engaged as field biologists might identify additional entry-level job skills over looked by this panel.

Based on this conclusion and findings, the researcher recommends that this study be replicated periodically (not less often than every 10 years) to determine the need for inclusion of new concepts and skills in wildlife curricula. In addition, the replication of this study would help with the elimination of outdated and obsolete curriculum content, which is a difficult task to accomplish.

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APPENDIX A

EMAIL LETTER OF INSTRUCTION TO INITIAL STEERING COMMITTEE

October 19, 2003

Dear Initial Steering Committee Member,

Thank you for serving as an initial committee member. As per our discussion, please nominate at least five innovative wildlife managers from your respective workforce (academic, public or private) to serve as an expanded steering committee and potential Delphi Panelist. Your nominations are confidential please do not notify the extended committee member. I will contact each nominee and solicit his or her participation as an expanded committee member and as a potential Delphi panelist. To help you focus on the issue to be addressed by the Delphi panel of experts, I have provided the focus question for the Delphi panel, the definition of entry-level job skills, and nomination criteria.

Focus Question - What are the job skills needed by entry-level wildlife managers?

Entry-level job skill – Individual use of knowledge, skills, and tools that supports the organization's core competencies for task completion, which are typically learned in a formal learning situation and are industry specific (Green 1999).

Nomination criteria - In your opinion,

1. Your nominee is a recognized, innovative wildlife management expert from your respective workforce sector (academic, public or private wildlife management); and

2. Your nominee supervises or works closely with entry-level wildlife managers.

Along with your nomination, please provide the following information for each nominee: name, workplace, email address, and area of wildlife management expertise. If you can only provide the name and workplace, I will be glad to locate the remaining information.

Please forward your list within five (5) working days via email to bdelany@mcneese.edu. If there are any questions, please feel free to contact me at 337-475-5692. Thank you for your time and efforts.

Sincerely,

Billy DeLany

APPENDIX B

FIRST EMAIL REQUEST TO EXPANDED COMMITTEE NOMINEES

Last spring (2003), you were nominated by one of your peers as a cutting edge professional who could help guide my current research efforts. The research is a Delphi panel of wildlife experts to determine a list of entry-level job skills needed by wildlife managers.

I would appreciate your assistance with nominating potential Delphi panel members. Thank you for your assistance in this research effort. Please open the attachment.

Your assistance will provide guidance essential to the wildlife profession.

Billy DeLany
Assistant Professor of Wildlife Management
Agriculture Department
McNeese State University
P. O. Box 92220
Lake Charles, LA 70609-2220
Office (337) 475-5692
Fax (337) 475-5699
bdelany@mcneese.edu

Attachment: Expanded Steering Committee Instructions

APPENDIX C

EMAIL LETTER OF INSTRUCTION TO EXPANDED STEERING COMMITTEE

Dear Expanded Steering Committee Member,

Thank you for serving as an expanded committee member. As per our discussion, please nominate at least five, innovative wildlife managers from your respective workforce (academic, public or private) to serve as Delphi Panelist. Your nominations are confidential please do not notify the nominee. From the pool of nominees, I will contact those selected and solicit their participation. To help you focus on the issue to be addressed by the Delphi panel of experts, I have provided the focus question for the Delphi panel, the definition of entry-level job skills, and nomination criteria.

Focus Question - What are the job skills needed by entry-level wildlife managers?

Entry-level job skill – Individual use of knowledge, skills, and tools that supports the organization's core competencies for task completion, which are typically learned in a formal learning situation and are industry specific (Green 1999).

Nomination criteria - In your opinion,

3. Your nominee is a recognized, innovative wildlife management expert from your respective workforce sector (academic, public or private wildlife management); and

4. Your nominee supervises or works closely with entry-level wildlife managers.

Along with your nomination, please provide the following information for each nominee: name, workplace, email address, and area of wildlife management expertise. If you can only provide the name and workplace, I will be glad to locate the remaining information.

Please forward your list within five (5) working days via email to bdelany@mcneese.edu. If there are any questions, please feel free to contact me at 337-475-5692. Thank you for your time and efforts.

Sincerely,

Billy DeLany

APPENDIX D

SECOND EMAIL REQUEST TO EXPANDED COMMITTEE NOMINEES

A friendly reminder and thank you for reviewing this request of assistance.

Last week you received a request to nominate cutting edge wildlife nominees for Delphi panel research to determine a list of entry-level job skills needed by wildlife managers. Your assistance is vital to the quality of this research. Delphi research is only as valid as the quality of the panel members. Please review my reasoning for this research. Please note that Delphi research is confidential.

This Delphi research is the result of several years of experience in natural resource management. Five years ago when I took the position as assistant professor of wildlife management at McNeese State University, I found a distinct conflict between academics and post-undergraduate employment needs. In conjunction with various education and professional articles in the Wildlife Society Bulletin and many conversations with wildlife professionals, I determined there were entry-level job skills that could be learned in higher education, which would increase the quality of learning for the student, institution, and profession. The problem, however, was to determine an adequate list of entry-level job skills needed by wildlife managers. Hence, this is the value of a Delphi panel of experts to develop a consensus list of entry-level skills.

This is when I turned to leaders in our profession to help guide the panel selection process. Three initial committee members nominated the expanded committee, which includes you. You were nominated by them as expanded committee members to nominate potential panelists. You were not selected at random. You were selected because of your innovative wildlife abilities and association with job skill needs of new wildlife employees.

Also in my email, I used the term “last spring.” The reason that I have not been in touch with you sooner was because of several serious illnesses in my family. My deadlines were delayed.

If you wish to provide assistance with this research, please open the attachment and complete the requested information. If not, please let me know that you do not wish to participate, and I will not send another reminder. Thank you for reviewing this request. If I may be of further assistance, please email bdelany@mcneese.edu

Thank you,
Billy DeLany
Assistant Professor of Wildlife Management
Agriculture Department
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Attachment: Expanded Steering Committee Instructions

APPENDIX E

THIRD EMAIL REQUEST TO EXPANDED COMMITTEE NOMINEES

A friendly reminder and thank you for reviewing my request for your assistance in this Delphi study of entry-level skills needed by wildlife managers.

Thank you for reviewing this final request to nominate cutting-edge wildlife professionals for this Delphi study. As previously mentioned, your leadership is important to the validity of this Delphi study. Please note that Delphi research is confidential between the coordinator (Billy DeLany) and each panelist.

If you wish to provide assistance with this research, please open the attachment and complete the requested information. If your nominees are not received within five working days of the transmission of this email request, your nominees will be excluded from the pool of potential panelists. Thank you for reviewing this request. If I may be of further assistance, please email bdelany@mcneese.edu.

Thank you,

Thank you,
Billy DeLany
Assistant Professor of Wildlife Management
Agriculture Department
McNeese State University
P. O. Box 92220
Lake Charles, LA 70609-2220
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APPENDIX F

TELEPHONE SCRIPT FOR PANEL SELECTION

Introduction

Hello, this is Billy DeLany, down at McNeese State University in Lake Charles, LA. I know you are busy, but if you have a moment I would like to share an idea with you. As you know, the wildlife profession is a mixture of academics and practical experience. Well, this is a major challenge in determining what is most important for undergraduate students to learn, and this is where you can help. While we recognize the academic concentrations of The Wildlife Society (TWS), we would like to identify important entry-level job skills. The purpose is to embed entry-level job skills in the academic concentrations. By doing this, we hope to improve the undergraduate's education and work readiness.

We are asking cutting-edge wildlifers that have been nominated by their peers, to identify these skills. If you agree to participate, you will be asked to respond to a series of three surveys. Think about it, 10-15-20 years ago, you were sitting where those students are now. Let's give them the benefit of your knowledge and experience.

Entry–level job skill is defined as: An Individual's use of knowledge, skills, and tools that supports the organization's core competencies for task completion, which are typically learned in a formal learning situation and are industry specific (Green 1999).

The Round One instrument use the focus question **"What are the job skills needed by entry-level wildlife managers?"** and the biological certification concentrations for The Wildlife Society.

The Round Two instrument is the compilation of Round One. The Round Two instrument allows you to rate each skill from 5 to 1 (5 most important, 1 is least).

The Round Three instrument is the compilation of Round two. However, each panelist's survey instrument is unique for each panelist. Each panelist's instrument will include his or her unique score for each skill and the group median. You will be asked to again rate each item based on your rating and the group median.

The data from Round Three will be averaged by item + SD and ranked by the item mean to produce a ranked list of entry-level job skills. For the purpose of this study, consensus on any one item is considered 51%.

APPENDIX G

ROUND ONE LETTER OF INSTRUCTION TO THE DELPHI PANEL

December 18, 2003

Dear Panelist,

Thank you for serving as a Delphi panelist. Your perspective list of entry-level job skills is anonymous and unique. However, feel free to discuss your list of job skills with your peers at work.

Save this letter in a convenient location, and when you are ready to input your entry-level job skills, open this letter, and click on the hotlink provided below to enter the Round One instrument.

For your convenience, a soft copy of the Round One instrument is attached for review and to initiate your list of entry-level job skills.

Please complete the survey by **January 9, 2004.**

If you have any questions or concerns, please contact us at bdelany@mcneese.edu or call 337-475-5692.

Thank you for your leadership,

Billy DeLany

http://www.mcneese.edu/colleges/sci/deptag/round_one_instrument.htm

APPENDIX H

ROUND ONE INSTRUMENT

Delphi Panel Study of Entry Level Work Skills Needed by Wildlife Managers.

Round One Letter of Instruction

Dear Panelist, December 18, 2003

Thank you for serving as a Delphi panelist. As per our discussion, please indicate the entry-level job skills that are important to your respective workforce (academic, public or private). Your perspective list of entry-level job skills is confidential. However, please feel free to discuss your list of job skills with your peers.

Provided for your convenience on the Round One instrument is the Delphi panel focus question, the definition of entry-level job skill, and the curricular concentrations for Wildlife Biologist Certification.

The validity of this research is the value to our industry and future wildlife professionals. Thank you for your leadership in this matter. Please complete the Round One instrument and return by January 9, 2004. If you have any questions or concerns, please contact us at bdelany@mcneese.edu or call 337-475-5692.

Sincerely,

Billy DeLany

Round One Instrument

Focus Question -What are the job skills needed by entry-level wildlife managers?

Entry-level job skills – Individual use of knowledge, skills, and tools that supports the organization's core competencies for task completion, which are typically learned in a formal learning situation and are industry specific (Green 1999[a]).

For each **concentration**, there is an example of an **entry-level job skill**. This example is to assist you. Unless you or another panelist suggests the example as an entry-level job skill, the example will not be used to formulate the list of entry-level skills.

Directions:

For each text field below, input each job skill separated by a semi-colon. Add as many as you deem relevant.

Please complete the instrument and forward by clicking the send button.

Enter Your Name Here	
Concentration[b]	**List of Entry-level Job Skills by Concentration**
Biological Sciences (wildlife management, biology, ecology, zoology, botany)	Plant identification. (example);
Physical Sciences	Soil identification. (example);
Basic Statistics	Use of descriptive statistics. (example);
Quantitative Sciences	Transect sampling. (example);
Humanities and Social Sciences	Understanding diverse w ildlife values. (example);

Communications	Professional presentation. (example);
Policy, Administration, and Law	Locating governmental regulations. (example);
Practical Daily Work Skills	Trailer backing. (example);

[a] Green, P. C. 1999. Building robust competencies: linking human resource systems to organizational strategies. Jossey-Bass Publishers. San Francisco, CA. USA.
[b] The Wildlife Society identifies six concentrations for Associate Wildlife Biologist and Wildlife Biologist certification. An eight category, practical daily work skills, was added to include skills that may be needed because of the work required.

Submit Reset

APPENDIX I

ROUND TWO LETTER OF INSTRUCTION TO THE DELPHI PANEL

February 13, 2004

Dear Panelist,

Thank you for your continued leadership and guidance in this research. There are 384 items on the questionnaire. Due to the number of items, there are eight sub-questionnaires (concentrations from the Round One instrument). This will allow you to complete Round Two without being overwhelmed at any one time.

While some items appear similar, please rate each item independently. After you complete the last item on each sub-questionnaire, click the submit button. However, your data will not be loaded into the main database until your last instrument is completed and submitted.

There appear to be two distinct categories among all entry-level work skill items (knowledge and ability). In the event you wish to comment on an item, a comment box accompanies each item. For your convenience, your Round One instrument is attached.

Please complete the Round Two instruments within five (5) working days. Thank you for your continued guidance. If I may be service to you, please email bdelany@mcneese.edu or call 337-475-5692.

Sincerely,

Billy DeLany

Round Two instrument hotlink

http://www.mcneese.edu/disSurvey/

APPENDIX J

ROUND TWO INSTRUMENT

For each entry-level job skill item, click on the "RATING" box, and a dropdown menu will appear to rate that job skill item. The rating selections are 5= high importance; 4= substantial importance; 3= moderate importance; 2= low importance; and 1= least importance. Click on the appropriate rating to rate each item.

Focus Question -**What are the job skills needed by entry-level wildlife managers?**

Entry-level job skills – Individual use of knowledge, skills, and tools that supports the organization's core competencies for task completion, which are typically learned in a formal learning situation and are industry specific (Green 1999).

Biological Science Skills

	ENTRY-LEVEL JOB SKILL	RATING	COMMENTS
1.	To have a sound foundation in biology.	RATING	
2.	To have a sound foundation of zoology.	RATING	
3.	To have basic knowledge of avian reproductive physiology.	RATING	
4.	To have basic knowledge of mammalian reproductive physiology.	RATING	
5.	The ability to identify signs and symptoms of common wildlife diseases.	RATING	
6.	To have an understanding of modern genetic approaches in wildlife conservation.	RATING	
7.	To have a working knowledge for ageing, sexing, trapping, capturing, handling, marking, and radio telemetry tracking of wildlife.	RATING	
8.	To have a basic knowledge of herpetology.	RATING	
9.	To have knowledge of wildlife damage management principles.	RATING	
10.	The ability to identify animal sign for animal damage control assessment.	RATING	
11.	The ability to identify mammals,	RATING	

	birds, reptiles, amphibians, and fish to species; insects to order; other invertebrates to phyla and order through the use of a key.		
12.	To have a basic knowledge of entomology with emphasis in aquatic insects and tree damaging pathogens.	RATING	
13.	The ability to locate, read, and comprehend reliable life history knowledge of mammals, birds, reptiles, amphibians, fish, insects, and other invertebrates.	RATING	
14.	To have knowledge of the factors affecting plant growth, reproduction, fitness, and survival including knowledge of diseases and genetics.	RATING	
15.	To have knowledge of the factors affecting wildlife growth, reproduction, fitness, and survival including knowledge of diseases and genetics.	RATING	
16.	To have knowledge of the effects of disease on wildlife growth, reproduction, fitness, and survival.	RATING	
17.	To have knowledge of the effects of genetics on wildlife growth, reproduction, fitness, and survival.	RATING	
18.	To have knowledge of techniques for estimating plant density and diversity.	RATING	
19.	To have knowledge of techniques for estimating animal density and diversity.	RATING	
20.	To have basic knowledge of mammology.	RATING	
21.	The ability to key-out a mammal species.	RATING	
22.	To have basic knowledge of mammalian anatomy.	RATING	
23.	The ability to perform basic necropsy procedures and protocol, which include sample	RATING	

	collection and tissue storage.		
24.	To have basic knowledge of mammalian physiology.	RATING	
25.	To have basic knowledge of Ornithology.	RATING	
26.	The ability to key-out an avian species.	RATING	
27.	To have basic knowledge of avian anatomy.	RATING	
28.	To have basic knowledge of avian physiology.	RATING	
29.	The ability to identify, sex, and age waterfowl.	RATING	
30.	The ability to identify, sex, and age neotropical birds.	RATING	
31.	The ability to key-out vertebrate species.	RATING	
32.	The ability to key-out invertebrate species.	RATING	
33.	To have a strong foundation in wildlife management principles and techniques.	RATING	
34.	To have a sound understanding of ecological principles and concepts of the relationships between plants, animals, and the environment.	RATING	
35.	To understand the need for conserving and protecting biodiversity in management planning.	RATING	
36.	To have a sound foundation of plant ecological principles and processes.	RATING	
37.	To have an understanding of range ecology and management principles.	RATING	
38.	To have a sound foundation of wildlife ecological principles and processes.	RATING	
39.	To have a working understanding of population dynamic principles.	RATING	
40.	To have a basic understanding of ecology (population, community, and ecosystem).	RATING	

41.	To have the basic understanding of landscape ecology for ecosystem restoration and management planning.	RATING	
42.	To have the basic understanding of wildland fire ecology.	RATING	
43.	The ability to recognize variables and relationships within an ecosystem (plant-animal-environment).	RATING	
44.	The ability to utilize man-made practices as useful ecological management tools (grazing, prescribed fire, herbicide application, logging, agronomic practices, etc).	RATING	
45.	To understand wildlife harvest management concepts and implications when developing management plans.	RATING	
46.	To have knowledge of all basic wildlife courses.	RATING	
47.	The ability to identify and utilize specific state-of-the-art wildlife management methods and techniques for high profile non-game species.	RATING	
48.	The ability to identify and utilize state-of-the-art wildlife management techniques for major game species.	RATING	
49.	To understand the importance of indicator species habitat requirements when preparing and implementing management strategies.	RATING	
50.	The ability to determine and identify species-specific habitat requirements.	RATING	
51.	The ability to determine and identify species specific limiting factors.	RATING	
52.	The ability to determine and identify species-specific predator/prey relationships.	RATING	
53.	The ability to determine and	RATING	

	identify species-specific agricultural depredation potentials.		
54.	To have knowledge of the life history requirements for waterfowl.	RATING	
55.	The ability to implement waterfowl surveys.	RATING	
56.	To have knowledge of waterfowl management techniques.	RATING	
57.	To have knowledge of shorebird life history.	RATING	
58.	The ability to implement survey techniques for shorebirds.	RATING	
59.	To have knowledge of shorebird management techniques.	RATING	
60.	To have knowledge of the life history requirements for various migratory birds.	RATING	
61.	The ability to implement survey techniques for migratory neotropical birds.	RATING	
62.	To be knowledgeable of white-tailed deer management techniques.	RATING	
63.	The ability to implement survey techniques for members of the Cervidae family.	RATING	
64.	To be knowledgeable of wildlife habitat management principles, tools, and techniques.	RATING	
65.	The ability to implement and assess the impacts of management on target and non-target species.	RATING	
66.	The ability to implement and assess habitat management techniques on target and non-target species habitat.	RATING	
67.	The ability to implement and assess prescribed fire for habitat restoration and management.	RATING	
68.	The ability to implement water level management strategies for habitat restoration and	RATING	

	management.		
69.	To have basic knowledge of forest management practices.	RATING	
70.	The ability to implement forest management and silvicultural practices for wildlife habitat restoration, maintenance, and management.	RATING	
71.	The ability to use current methods of plant eradication to control invasive exotic species for habitat restoration and management.	RATING	
72.	To have a sound foundation in botany.	RATING	
73.	To understand the basic principles of plant physiology.	RATING	
74.	To have basic knowledge of the taxonomy of spermatophytes.	RATING	
75.	To have basic knowledge and skills of dendrology (keying, collecting, preserving, and ageing plants).	RATING	
76.	The ability to key-out regional and national plant species.	RATING	
77.	The ability to locate species specific plant life history and determine plant species value to wildlife.	RATING	
78.	The ability to locate and interpret reliable information.	RATING	
79.	The ability to identify, classify, and compare plant communities by implementing plant surveying and mapping techniques (e.g. Daubenmire habitat method).	RATING	
80.	The ability to identify the successional stage of a plant community.	RATING	
81.	The ability to identify the current successional stage of a plant community and predict the wildlife inhabitants.	RATING	
82.	The ability to identify wetland plant species and community	RATING	

	composition to determine the wetland ecosystem type.		
83.	The ability to manage greentree and moist soil units for target species and species diversity.	RATING	
84.	To have knowledge of wetland ecology and management.	RATING	
85.	The ability to develop, implement, and manage an adaptive resource habitat management plan.	RATING	
86.	The ability to use the internet and computer as tools to aid in biological/habitat management.	RATING	
87.	The ability to implement adaptive resource management to evaluate habitat response and future management options.	RATING	
88.	To be knowledgeable in forest ecology and management.	RATING	
89.	To have knowledge of forest management with emphasis on hardwood management.	RATING	
90.	To have knowledge of forest management techniques that pertain to forest dwelling migratory birds.	RATING	
91.	The ability to age various wildlife species by locating and implementing species-specific techniques.	RATING	
92.	The ability to age deer by dental wear.	RATING	
93.	The ability to sex wildlife.	RATING	
94.	The ability to trap wildlife.	RATING	
95.	The ability to handle wildlife.	RATING	
96.	The ability to visually and auditorially identify wildlife.	RATING	
97.	The ability to identify wildlife habitat use by wildlife sign.	RATING	
98.	The ability to administer proper animal care through animal husbandry techniques and contemporary knowledge of animal welfare issues.	RATING	
99.	To have knowledge of plant	RATING	

	evolution, which includes ecological, genetic and molecular techniques.		
100.	To have knowledge of animal evolution, which includes ecological, genetic and molecular techniques.	RATING	
101.	The ability to merge the management principles of upland, wetland, and aquatic systems to meet wildlife management and biodiversity objectives.	RATING	
102.	The ability to apply ecological concepts and models to problems in natural resource and ecosystem management.	RATING	
103.	To have knowledge of agrostology for the study of grasses and grassland habitat management.	RATING	
104.	To be familiar with localized endangered and threatened species.	RATING	
105.	To have knowledge of basic land uses (e.g. aquaculture, crop production, forestry, grazing, wildlife).	RATING	
106.	To have knowledge of coniferous ecosystems.	RATING	
107.	To have knowledge of fish biology and management.	RATING	

Physical Science Skills

	ENTRY-LEVEL JOB SKILL	RATING	COMMENTS
108.	To have basic knowledge of agronomy (soil characteristics, identification, and productivity).	RATING	
109.	The ability to manage the soil for improved environmental and economic productivity.	RATING	
110.	The ability to use contemporary soil erosion control techniques within the wildlife management area.	RATING	

111.	The ability to understand a soil analysis and determine fertilizer and lime recommendations.	RATING	
112.	The ability to identify non-wetland and wetland soil types by soil characteristics, soil maps, and imagery.	RATING	
113.	To have a basic knowledge of hydrology.	RATING	
114.	The ability to use soil type and topography to assess the hydrologic regime.	RATING	
115.	The ability to use surface soils, sub-surface soils, and topography information to assess surface water retention, ground water components, and hydrologic cycles for wildlife management planning.	RATING	
116.	The ability to monitor and interpret basic soil and water models to estimate sediment yield, water quality, and water heating.	RATING	
117.	To have knowledge of basic water quality monitoring techniques.	RATING	
118.	To understand the relationship between soil type, soil fertility, soil hydrology, and plant community to assess ecosystem cycling, productivity, and distribution.	RATING	
119.	To understand the relationship between abiotic factors (climate, hydrology, soils) and biotic productivity and diversity.	RATING	
120.	The ability to use plant community indices to determine wildlife habitat value.	RATING	
121.	To understand the relationships between geography and ecosystems.	RATING	
122.	To understand and recognize the relationships between geology and ecosystems of the work area, district and region.	RATING	

123.	To recognize and understand the relationship between climate and ecosystems.	RATING	
124.	The ability to use basic meteorological monitoring equipment and apply meteorological data for wildlife management planning.	RATING	
125.	To recognize and understand the relationship between regionalized weather patterns (daily, seasonal, and long-term patterns) and weather impacts on wildlife.	RATING	
126.	To recognize and understand the relationship between elevation and ecosystem diversity.	RATING	
127.	The ability to implement and assess appropriate aquatic habitat management techniques.	RATING	
128.	The ability to identify, locate, implement, and assess site-specific controls for non-point source pollution to improve water quality.	RATING	
129.	The ability to assess current and potential wildlife productivity in upland habitats.	RATING	
130.	The ability to determine the suitability of land for agronomic production.	RATING	
131.	The ability to implement and manage moist soil unit plant productivity.	RATING	
132.	The ability to assess and implement irrigation techniques for land use.	RATING	
133.	The ability to apply wildfire risk assessment models to "species at risk".	RATING	
134.	The ability to effectively manage prescribed fire to protect air quality.	RATING	
135.	To have a basic knowledge of physical and organic chemistry to aid with chemical applications	RATING	

	(fertilizer, herbicides, and pesticides).		
136.	To have knowledge of water chemistry and water quality sampling methods.	RATING	
137.	The ability to monitor water quality using direct and remote automated equipment for wildlife management planning.	RATING	
138.	To have knowledge of organic and biochemistry with specific information on toxicology and environmental health.	RATING	
139.	The ability to map and inventory a watershed.	RATING	
140.	To have a practical understanding of meteorology	RATING	
141.	To have the basic knowledge of organic chemistry.	RATING	
142.	To have the basic knowledge of inorganic chemistry.	RATING	

Basic Statistic Skills

	ENTRY-LEVEL JOB SKILL	RATING	COMMENTS
143.	The ability to use descriptive statistics in the biometric analysis of wildlife phenomenon.	RATING	
144.	To have a basic understanding of statistical methods to estimate wildlife populations.	RATING	
145.	To be familiar with SAS.	RATING	
146.	The ability to understand basic (inferential) statistical concepts.	RATING	
147.	The ability to conduct simple analysis with guidance from a scientist or biometrician.	RATING	
148.	To be able to read and understand complex research designs.	RATING	
149.	To be able to read and understand reports that utilize advanced statistical concepts (ANCOVA, Logistic Regression, etc.)	RATING	

150.	The ability to perform routine analysis of raw data using descriptive statistics.	RATING	
151.	The ability to understand the assumptions of parametric and non-parametric statistics.	RATING	
152.	To understand the application of statistics to wildlife management and research.	RATING	
153.	The ability to apply the concepts of accuracy, precision and the scientific method for hypothesis testing.	RATING	
154.	The ability to read and interpret scientific articles to understand the study results.	RATING	
155.	The ability to use statistics to plan, implement, and assess science-based wildlife management programs (adaptive resource management).	RATING	
156.	To understand the effect of sample size on research findings and management outcomes.	RATING	
157.	To have knowledge of sampling principles for assessing wildlife populations and wildlife habitat.	RATING	
158.	To understand the value of scientific survey sampling in wildlife management.	RATING	
159.	The ability to determine the appropriate sample size for wildlife research and adaptive resource management.	RATING	
160.	To understand the basic variables and relationships of wildlife population dynamics.	RATING	
161.	The ability to recognize a statistically valid sample versus some "neat information".	RATING	
162.	The ability to use statistical software packages to record and evaluate data.	RATING	
163.	The ability to implement population-adaptive harvest management techniques.	RATING	

164.	The ability to statistically analyze population data to determine population growth and recruitment potential.	RATING	
165.	The ability to design a sampling survey and analyze the survey data to estimate and monitor population trends.	RATING	
166.	The ability to use descriptive statistics to conduct habitat analysis and predict future habitat changes.	RATING	
167.	The ability to use inferential statistics to estimate home range.	RATING	
168.	The ability to use scientific journal writings to develop a theoretical approach to problem solving.	RATING	
169.	To have experience in statistical procedure and data analysis.	RATING	

Quantitative Science Skills

	ENTRY-LEVEL JOB SKILL	RATING	COMMENTS
170.	To understand the difference between inventorying (what's there), monitoring (what's it doing), and research (why's it doing that).	RATING	
171.	The ability to develop, implement, and complete comprehensive wildlife management plans for individual species and groups of species.	RATING	
172.	The ability to apply classification and ordination statistics to determine ecological groupings and gradients.	RATING	
173.	The ability to implement and complete biodiversity assessments.	RATING	
174.	The ability implement risk assessments for "species at risk".	RATING	
175.	To be introduced to modeling as a wildlife management tool.	RATING	

176.	The ability to apply population models as wildlife management tools (population estimates, indices, life tables and projection, survival, band return, capture-recapture models, sightability models, and minimum viable population analysis).	RATING	
177.	To be familiar with general wildlife sampling methods.	RATING	
178.	The ability to organize survey sampling and monitoring techniques for wildlife (mammals, birds, reptiles, amphibians, fish, and invertebrates) (e.g. capture, marking, radio telemetry, sexing, ageing).	RATING	
179.	The ability to organize survey sampling and monitoring techniques for plants to evaluate wildlife habitat (e.g. imagery; sampling methods - transects (random, stratified, cluster), data (plots, plotless, point intercept).	RATING	
180.	The ability to design, implement, and interpret field surveys.	RATING	
181.	The ability to estimate animal populations by ground transects.	RATING	
182.	The ability to estimate animal populations by aerial transects.	RATING	
183.	The ability to plan, implement, and assess the findings of a point-center plot survey.	RATING	
184.	The ability to plan, implement, and assess a belt-line transect sampling design.	RATING	
185.	The ability to plan, implement, and assess the findings of a plot transect survey.	RATING	
186.	The ability to plan, implement, and assess the findings of a browse survey.	RATING	
187.	The ability to plan, implement, and assess the findings of a	RATING	

	public opinion survey (questionnaires).		
188.	The ability to plan, implement, and assess the findings of random transect sampling.	RATING	
189.	The ability to identify the pertinent factors which affect a transect sampling route.	RATING	
190.	The ability to identify all plants and plant communities within a sampling point.	RATING	
191.	The ability to identify soil types and characteristics within a sampling point.	RATING	
192.	The ability to conduct deer surveys using current technology.	RATING	
193.	The ability to conduct waterfowl surveys utilizing current technology.	RATING	
194.	The ability to conduct shorebird surveys using current technology.	RATING	
195.	The ability to conduct woodcock surveys using current technology.	RATING	
196.	The ability to conduct mourning dove surveys using current technology.	RATING	
197.	The ability to conduct rail surveys using current technology.	RATING	
198.	The ability to use, develop, or adapt habitat suitability index models to estimate habitat quality and potential.	RATING	
199.	The ability to implement a species-specific population viability analysis.	RATING	
200.	To have the basic knowledge and familiarity with modern surface mapping and remote sensing techniques to include computer usage, GIS, GPS, aerial photography, satellite imagery, and cartography to	RATING	

	model, monitor, and assess natural resources.		
201.	The ability to estimate and identify surface features through aerial photograph interpretation.	RATING	
202.	The ability to use of GIS, GPS, aerial photography, cartography, and map reading for natural resource management planning, monitoring, and assessment.	RATING	
203.	The ability to use basic land surveying techniques (e.g. shooting elevations, determining boundaries, setting grade, road construction, logging systems).	RATING	
204.	To have knowledge of spatial and temporal landscape analysis.	RATING	
205.	To be familiar with various radio telemetry techniques.	RATING	
206.	To develop critical quantitative thinking skills by completing math courses through college calculus.	RATING	
207.	To develop critical quantitative thinking skills by completing math courses through college algebra.	RATING	
208.	To develop critical quantitative thinking skills by completing math courses through college trigonometry.	RATING	
209.	To develop critical quantitative thinking skills by completing college physics.	RATING	
210.	The ability to use timber inventory sampling techniques that are commonly used in modern forest management.	RATING	
211.	The ability to implement variable-plot tree cruising using a Relaskop instrument.	RATING	
212.	To have a broad understanding of vegetative sampling techniques commonly used in modern land management activities.	RATING	

213.	To have knowledge of the agriculture/wildland interface.	RATING	
214.	To have knowledge of the urban/wildland interface.	RATING	
215.	To have knowledge of grassland/rangeland inventory techniques.	RATING	
216.	To have knowledge of silvicultural biometrics.	RATING	
217.	To have basic computational skills.	RATING	
218.	The ability to accurately measure and record data.	RATING	

Communication Skills

	ENTRY-LEVEL JOB SKILL	RATING	COMMENTS
219.	The ability to be an effective public speaker.	RATING	
220.	The ability to professionally present information to a group of peers.	RATING	
221.	The ability to use software programs (e.g. PowerPoint) to construct one-on-one, lay-groups, professional, and web-based presentations to reach a diversity of audiences.	RATING	
222.	The ability to avoid or resolve potential human conflict situations with the most effective and appropriate conflict resolution methods.	RATING	
223.	The ability to use informed consent to effectively accomplish the mission, when consensus development is ineffective.	RATING	
224.	The ability to resolve conflict through consensus building.	RATING	
225.	The ability to skillfully communicate with diverse groups and individuals.	RATING	
226.	The ability to write a simple technical report.	RATING	
227.	The ability to professionally and	RATING	

	effectively communicate one-on-one at any level of understanding (technical and lay person).		
228.	The ability to explain complex issues to layman stakeholders.	RATING	
229.	The ability to effectively present a professional presentation to a large audience.	RATING	
230.	The ability to effectively manage diverse visitors or user groups.	RATING	
231.	The ability to speak to a group of people in a variety of forms and formats.	RATING	
232.	The ability to interact well with stakeholder groups.	RATING	
233.	The ability to effectively manage and interact with diverse staff personnel.	RATING	
234.	The ability to deal with and discuss controversial issues in an hostile environment.	RATING	
235.	The ability of the natural resource manager to effectively work with stakeholders through contemporary public relation practices.	RATING	
236.	The ability to articulate natural resource knowledge and management intent to the public in an understandable manner, which requires understanding the audience's perspective.	RATING	
237.	The ability to communicate points convincingly to the public in print.	RATING	
238.	The ability to write effectively for various audiences.	RATING	
239.	The ability to communicate scientific information to managers and scientists with sound technical writing skills.	RATING	
240.	The ability to communicate through written professional correspondence.	RATING	

241.	The ability to write plans, reports, technical papers, and other documents using good grammar, punctuation, and techniques.	RATING	
242.	The ability to effectively communicate ideas and technical information through popular publications.	RATING	
243.	The ability to speak with the media and get your most important message across in a 30 second sound bite.	RATING	
244.	The ability to summarize and effectively communicate information through charts and figures for presentation and publication.	RATING	
245.	The ability to be an effective and responsive active listener.	RATING	
246.	The ability to develop and maintain interpersonal relationships.	RATING	
247.	The ability to be a team player and recognize the role of effective teamwork in organizations.	RATING	
248.	The ability to lead and follow as the situation warrants.	RATING	
249.	The ability to effectively network and interact with diversified groups (e.g. public, private, academic, media).	RATING	
250.	The ability to keep a positive, friendly, and outgoing attitude.	RATING	
251.	The ability to use specific knowledge to interact, influence, and communicate with community groups (action leaders, opinion leaders, etc.).	RATING	
252.	The ability to write grants.	RATING	
253.	The ability to communicate through good telephone etiquette.	RATING	
254.	The ability to interact, communicate, and respond with	RATING	

	others on a daily basis to facilitate effective "win-win" situation.		
255.	The ability to use marketing principles and effectively communicate ideas through educational and awareness programs to stakeholders.	RATING	
256.	The ability to edit and critically review communication media (manuscripts and presentations).	RATING	
257.	The ability to work with difficult people.	RATING	
258.	The ability to email correspondence.	RATING	
259.	The ability to navigate and locate information on the internet.	RATING	
260.	The ability to communicate using computer technology.	RATING	

Humanity Skills

	ENTRY-LEVEL JOB SKILL	RATING	COMMENTS
261.	The ability to understand diverse wildlife values and use that information to design and implement environmental education and/or outreach programs.	RATING	
262.	The ability to understand and apply human social, demographic, economic, and political implications as to related wildlife law, sustainable resources, management, harvest, conservation, preservation, and assessment.	RATING	
263.	The ability understand public perception of wildlife and associated habitats.	RATING	
264.	To understand and appreciate diverse human cultures and associated wildlife value systems.	RATING	
265.	The ability to understand	RATING	

	historical and contemporary roles of society in wildlife management.		
266.	The ability to understand historical and contemporary roles of society in forest management.	RATING	
267.	The ability to recognize human need for outdoor recreation and to understand the apparent implications if that need is denied or suppressed (conflict management).	RATING	
268.	The ability to recognize the history, role, and importance of consumptive wildlife use (hunting, fishing, and trapping) as a wildlife conservation/management tool.	RATING	
269.	The ability to understand the traditions, culture, and heritage surrounding consumptive values such as hunting, fishing, and trapping.	RATING	
270.	The ability to recognize the social implications of wildlife management actions and pre-planning responses to questions and challenges made by those who do not understand or support hunting as a wildlife management tool.	RATING	
271.	The ability to recognize, understand, and appreciate diverse cultural perspectives regarding wildlife values (stakeholder diversity).	RATING	
272.	The ability to recognize the value of human diversity in the workplace.	RATING	
273.	The ability to work professionally in order to be accepted as professionals by future society.	RATING	
274.	The ability to recognize and understand diverse cultural natural resource values.	RATING	

275.	The ability to understand the need for social acceptance of consumptive natural resource use (hunting, trapping, and fishing).	RATING	
276.	The ability to relate wildlife or habitat trends to human dynamics.	RATING	
277.	To have a foundation of wildlife conservation and land management history.	RATING	
278.	The ability to understand that changing U.S. demographics will impact future wildlife management.	RATING	
279.	To recognize the impact of giving animals' human traits by TV and other medias, which will affect society's acceptance of consumptive wildlife use (hunting and trapping).	RATING	
280.	The ability to apply real world economics and capitalism in wildlife management.	RATING	
281.	The ability to apply macro and microeconomics concepts to wildlife management.	RATING	
282.	To have knowledge of political science.	RATING	
283.	The ability to recognize how diverse social values affect wildlife management decisions.	RATING	
284.	To have an understanding of conservation biology	RATING	
285.	The ability to develop and maintain partnerships in wildlife management.	RATING	
286.	The ability to function as a well-rounded member of society.	RATING	
287.	The ability to understand "anti-group stakeholders" (e.g. PETA) and their perspectives.	RATING	
288.	The ability to understand private landowner needs and their relationship to wildlife and land management.	RATING	

289.	The ability to develop personal environmental ethics and a resource philosophy.	RATING	
290.	To have knowledge of political and social history at the local, state, and national level, which involve wildlife management.	RATING	
291.	To be familiar with global historic and contemporary wildlife issues.	RATING	
292.	The ability to locate and retrieve reliable wildlife information from the library and internet resources.	RATING	

Policy Administration Skills

	ENTRY-LEVEL JOB SKILL	RATING	COMMENTS
293.	The ability to understand the agency mission statement and the employee's contribution to accomplish the agency mission.	RATING	
294.	The ability to possess a working knowledge of local, state, and national political and legislative processes to effectively accomplish organizational goals.	RATING	
295.	The ability to apply basic knowledge of business administration and management in the workplace.	RATING	
296.	The ability to apply basic budgeting and accounting skills in the workplace.	RATING	
297.	The ability to effectively understand workplace policy regarding employee supervision, hiring, firing, EEO, and budgeting.	RATING	
298.	The ability to apply sensitivity training in the workplace.	RATING	
299.	The ability to understand the various roles and responsibilities of federal and state government at the executive, legislative, and judicial levels.	RATING	

300.	To possess the basic knowledge of the origin and relevance of wildlife regulations.	RATING	
301.	The ability to understand how state legislative processes impact the agency's mission.	RATING	
302.	The ability to understand how the federal legislative processes impacts an agency's mission.	RATING	
303.	The ability to formulate public use regulations.	RATING	
304.	The ability to interpret and apply laws and policy to agency natural resource programs.	RATING	
305.	The ability to interpret and apply regulation and policy in practical situations.	RATING	
306.	The ability to recognize the differences between law, policy, and guidelines.	RATING	
307.	The ability to understand the structure and function of state agency administrations.	RATING	
308.	The ability to understand the structure and function of federal agency administrations.	RATING	
309.	The ability to understand the roles and responsibilities of various local, state, and federal agencies.	RATING	
310.	The ability to identify key governmental administrators that formulate wildlife policy.	RATING	
311.	The ability to electronically and manually locate and understand local, state, and federal regulations that pertain to wildlife management.	RATING	
312.	The ability to reference legal codes that provide the mandate for agency administration and operation.	RATING	
313.	To know the purpose and fundamentals of major natural resource laws (Clean Water Act, National Environmental Policy	RATING	

	Act, Endangered Species Act, Lacey Act, Migratory Bird Treaty Act, etc.).		
314.	The ability to understand how federal and state threatened/endangered species laws relate to the individual's workplace, agencies, and landowners.	RATING	
315.	To understand how federal, state, and other organizations classify species.	RATING	
316.	The ability to integrate the needs of wildlife, environment, and humans with natural resource management.	RATING	
317.	To be exposed to the role of government regulations and the importance of compliance.	RATING	
318.	The ability to work within existing laws, regulations, and policies.	RATING	
319.	To have basic knowledge of water rights law.	RATING	
320.	The ability to recognize and understand state game laws.	RATING	
321.	To have basic knowledge of the wildlife profession, prominent wildlife leaders, and the history of wildlife legislation in the U.S.A. (wildlife profession, Aldo Leopold, Pittman-Robertson, Lacy, ESA, etc.).	RATING	
322.	To have basic knowledge of business law.	RATING	
323.	The ability to understand risk analysis and management.	RATING	
324.	The ability to understand how science informs policy and decision makers.	RATING	
325.	To have basic knowledge in law enforcement and the wildife agent's duties.	RATING	
326.	To have basic knowledge of major land programs affecting wildife.	RATING	

327.	To know the agencies and CEO's that affect state and federal wildlife programs.	RATING	
328.	To have knowledge and understanding of non-government organizations in the natural resource field and their goals.	RATING	
329.	To have basic knowledge and understanding of wetland regulations (Clean Water Act, Section 404, Food securities Act, Wetland Reserve Program).	RATING	
330.	To have knowledge of major case histories involving controversial resource issues such as the Monogahela decision, Everglades, Columbia River dams, Chesapeake Bay pesticides, Northwest old growth forests and Northwest Forest Plan by the Clinton Administration.	RATING	

Practical Daily Skills

	ENTRY-LEVEL JOB SKILL	RATING	COMMENTS
331.	To be defensive driving certified.	RATING	
332.	The ability to perform routine service and emergency repair of vehicles and equipment.	RATING	
333.	The ability to operate a vehicle with a standard or automatic transmission.	RATING	
334.	The ability to maneuver a 4-wheel drive vehicle with a standard or automatic transmission.	RATING	
335.	The ability to maneuver a vehicle and trailer.	RATING	
336.	To have basic knowledge and use of various farm equipment and implements.	RATING	
337.	To have basic knowledge and use of heavy equipment.	RATING	

338.	To have knowledge of different types of hunting equipment.	RATING	
339.	To have knowledge of different types of fishing equipment.	RATING	
340.	The ability to operate a motorized boat as indicated by training certification.	RATING	
341.	The ability to operate an ATV as indicated by training certification.	RATING	
342.	To have knowledge of and safely use firearms.	RATING	
343.	To be first aid and CPR qualified.	RATING	
344.	To have basic camping and outdoor survival skills.	RATING	
345.	The ability to navigate by GPS, map, and compass.	RATING	
346.	The ability to read and follow blueprints and shop drawings.	RATING	
347.	The ability to use computers for word processing, developing PowerPoint presentations, canned programs (Program Mark and Program Distance), database management, and statistical packages.	RATING	
348.	The basic ability for repair and maintenance of computers (troubleshooting for repair and maintenance).	RATING	
349.	The ability to use Microsoft Office Suite for word-processing, presenting, database management, and data analysis.	RATING	
350.	The ability to use the scientific method for basic research and problem solving in wildlife management.	RATING	
351.	The ability and willingness to learn new "things" in everyday life (life-long learning through reading, conferences, etc.)	RATING	
352.	The ability to develop and organize annual and weekly work plans.	RATING	

353.	The ability to fabricate metal (welding/cutting operations).	RATING	
354.	The ability to be an accountable and dependable self-starter who can work independently, efficiently, and safely with minimal supervision in all settings (individual, group, office, laboratory, field).	RATING	
355.	The ability to communicate by radio.	RATING	
356.	The ability to document information via camera operation.	RATING	
357.	To have basic knowledge and basic abilities to use hand tools for carpentry, electrical, plumbing, metal fabrication, and general maintenance.	RATING	
358.	To have basic knowledge of construction.	RATING	
359.	The ability to safely operate a chainsaw and properly fell a tree.	RATING	
360.	The demonstrated ability to tolerate adverse field conditions and excel under extended duty in the field.	RATING	
361.	The ability to apply coursework to a field setting for writing a management plan and report writing.	RATING	
362.	The ability to identify potential ecological problems in the field.	RATING	
363.	The ability to establish credibility with colleagues and the public.	RATING	
364.	The ability to understand habitat and population manipulation as wildlife management tools.	RATING	
365.	The ability to be an ethical wildlife manager.	RATING	
366.	The ability to develop and possess good observational skills.	RATING	
367.	The ability to indicate wildife	RATING	

	work experience on your resume (volunteer, internship, summer employment).		
368.	The ability to balance family and work.	RATING	
369.	The ability to maintain a good attitude. Regardless of training, attitude is the best predictor of success. Individuals who are fair and honest with others are successful. Even if an individual, with only average intelligence and training, who can effectively deal with others will succeed better than most others.	RATING	
370.	The ability to understand the basics of fire and fire fighting (wildland fire training/certification: Federal s130/190)	RATING	
371.	The ability to operate hand-held computers.	RATING	
372.	The ability to locate and identify potential employment opportunities.	RATING	
373.	The ability to effectively manage relationships with lessees (e.g. hunting clubs).	RATING	
374.	The ability to manage time (time management).	RATING	
375.	The ability to recognize and accept goals of the employer.	RATING	
376.	The ability to work with management and research personnel of the public and private sectors.	RATING	
377.	The ability to install, maintain, and use basic field sampling equipment.	RATING	
378.	The ability to follow basic laboratory procedures.	RATING	
379.	The ability to navigate in a forest landscape using maps/photos.	RATING	
380.	To have experience in small	RATING	

	aircraft and helicopters		
381.	The ability to use a winch on a vehicle.	RATING	
382.	To have experience with wetsuits/snorkeling.	RATING	
383.	To have experience in fish shocking equipment.	RATING	

APPENDIX K

ROUND THREE LETTER OF INSTRUCTION

March 26, 2004

Dear Panelist,

Thank you for your perseverance and leadership. Attached below is the hotlink for your unique sub-instruments. Completing these surveys is your final duty for this research.

Your name is your password into your specific database. **You must input your name exactly as follows:**

Your sub-instruments are unique to you. Each sub-instrument has your round two rating and the overall group median for each item. If your rating is within one scale rating of the median ($\pm$ 1), your rating is considered in consensus or in agreement with the group median. These items do not need your attention.

Please re-examine only the yellow highlighted items. Then, for the highlighted items, please take one of the following two actions:

1) **Rate the item within one scale interval of the median; or**
2) **Input your round two rating and provide a brief explanation as to why your rating is more accurate.**

Panel consensus on an item is a form of subjective truth. If you disagree with the group rating, do not be coerced into group conformity. While the research purpose is to ascertain a list of ranked of entry-level, wildlife management job skills, each panelist is employed in a unique setting that is grouped into one of three workplaces (academic, private, and public).

Please complete the round three sub-instruments as soon as possible (within 5 working days or less). Your timely assistance will allow me to complete the analysis during the spring break. If you cannot access any instrument, please notify me immediately. If I may be of further service, you may email bdelany@mcneese.edu or call 337-475-5692.

Click on the HOTLINK below and you will be brought to your instruments.

www.mcneese.edu/disSurvey/round3.html

With sincere appreciation of your efforts and time,

Billy

APPENDIX L

ROUND THREE SUB-INSTRUMENT HOTLINKS

Entry-Level Job Skills Delphi Survey

- Biological Science Skills
- Physical Science Skills
- Basic Statistic Skills
- Quantitative Science Skills
- Humanities Skills
- Communication Skills
- Policy Administration Skills
- Practical Daily Skills

APPENDIX M

ROUND THREE INSTRUMENT

As you complete each sub-instrument, please keep in mind the focus question.

"What re the job skills needed by entry-level wildlife managers?"

After reviewing your round two rating and the group round two rating for each item in yellow, please take one of two actions.

1) Rate the yellow item within one scale interval or
2) Keep your round two rating and provide a brief explanation as to why your rating is more accurate.

Please Enter Your Name :		Submit

Biological Science Skills

	Entry-Level Job Skill	Overall Group Mean	Panelist Unique Rating	Importance Rating	Brief Explanation
384.	To have a sound foundation in biology.				
385.	To have a sound foundation of zoology.				
386.	To have basic knowledge of avian reproductive physiology.				
387.	To have basic knowledge of mammalian reproductive physiology.				
388.	The ability to identify signs and symptoms of common wildlife diseases.				
389.	To have an understanding of modern genetic approaches in wildlife conservation.				
390.	To have a working knowledge for ageing, sexing, trapping, capturing, handling, marking, and radio telemetry tracking of wildlife.				

391.	To have a basic knowledge of herpetology.				
392.	To have knowledge of wildlife damage management principles.				
393.	The ability to identify animal sign for animal damage control assessment.				
394.	The ability to identify mammals, birds, reptiles, amphibians, and fish to species; insects to order; other invertebrates to phyla and order through the use of a key.				
395.	To have a basic knowledge of entomology with emphasis in aquatic insects and tree damaging pathogens.				
396.	The ability to locate, read, and comprehend reliable life history knowledge of mammals, birds, reptiles, amphibians, fish, insects, and other invertebrates.				
397.	To have knowledge of the factors affecting plant growth, reproduction, fitness, and survival including knowledge of diseases and genetics.				
398.	To have knowledge of the factors affecting wildlife growth, reproduction, fitness, and survival including knowledge of diseases and genetics.				
399.	To have knowledge of the effects of disease on wildlife growth, reproduction, fitness, and survival.				
400.	To have knowledge of the effects of genetics on wildlife growth, reproduction, fitness, and				

	survival.				
401.	To have knowledge of techniques for estimating plant density and diversity.				
402.	To have knowledge of techniques for estimating animal density and diversity.				
403.	To have basic knowledge of mammology.				
404.	The ability to key-out a mammal species.				
405.	To have basic knowledge of mammalian anatomy.				
406.	The ability to perform basic necropsy procedures and protocol, which include sample collection and tissue storage.				
407.	To have basic knowledge of mammalian physiology.				
408.	To have basic knowledge of Ornithology.				
409.	The ability to key-out an avian species.				
410.	To have basic knowledge of avian anatomy.				
411.	To have basic knowledge of avian physiology.				
412.	The ability to identify, sex, and age waterfowl.				
413.	The ability to identify, sex, and age neotropical birds.				
414.	The ability to key-out vertebrate species.				
415.	The ability to key-out invertebrate species.				
416.	To have a strong foundation in wildlife management principles and techniques.				
417.	To have a sound understanding of ecological principles and concepts of the relationships between plants, animals, and the environment.				

418.	To understand the need for conserving and protecting biodiversity in management planning.				
419.	To have a sound foundation of plant ecological principles and processes.				
420.	To have an understanding of range ecology and management principles.				
421.	To have a sound foundation of wildlife ecological principles and processes.				
422.	To have a working understanding of population dynamic principles.				
423.	To have a basic understanding of ecology (population, community, and ecosystem).				
424.	To have the basic understanding of landscape ecology for ecosystem restoration and management planning.				
425.	To have the basic understanding of wildland fire ecology.				
426.	The ability to recognize variables and relationships within an ecosystem (plant-animal-environment).				
427.	The ability to utilize man-made practices as useful ecological management tools (grazing, prescribed fire, herbicide application, logging, agronomic practices, etc).				
428.	To understand wildlife harvest management concepts and implications when developing management plans.				
429.	To have knowledge of all basic wildlife courses.				

430.	The ability to identify and utilize specific state-of-the-art wildlife management methods and techniques for high profile non-game species.				
431.	The ability to identify and utilize state-of-the-art wildlife management techniques for major game species.				
432.	To understand the importance of indicator species habitat requirements when preparing and implementing management strategies.				
433.	The ability to determine and identify species-specific habitat requirements.				
434.	The ability to determine and identify species specific limiting factors.				
435.	The ability to determine and identify species-specific predator/prey relationships.				
436.	The ability to determine and identify species-specific agricultural depredation potentials.				
437.	To have knowledge of the life history requirements for waterfowl.				
438.	The ability to implement waterfowl surveys.				
439.	To have knowledge of waterfowl management techniques.				
440.	To have knowledge of shorebird life history.				
441.	The ability to implement survey techniques for shorebirds.				
442.	To have knowledge of shorebird management techniques.				

443.	To have knowledge of the life history requirements for various migratory birds.				
444.	The ability to implement survey techniques for migratory neotropical birds.				
445.	To be knowledgeable of white-tailed deer management techniques.				
446.	The ability to implement survey techniques for members of the Cervidae family.				
447.	To be knowledgeable of wildlife habitat management principles, tools, and techniques.				
448.	The ability to implement and assess the impacts of management on target and non-target species.				
449.	The ability to implement and assess habitat management techniques on target and non-target species habitat.				
450.	The ability to implement and assess prescribed fire for habitat restoration and management.				
451.	The ability to implement water level management strategies for habitat restoration and management.				
452.	To have basic knowledge of forest management practices.				
453.	The ability to implement forest management and silvicultural practices for wildlife habitat restoration, maintenance, and management.				
454.	The ability to use current methods of plant eradication to control				

	invasive exotic species for habitat restoration and management.				
455.	To have a sound foundation in botany.				
456.	To understand the basic principles of plant physiology.				
457.	To have basic knowledge of the taxonomy of spermatophytes.				
458.	To have basic knowledge and skills of dendrology (keying, collecting, preserving, and ageing plants).				
459.	The ability to key-out regional and national plant species.				
460.	The ability to locate species specific plant life history and determine plant species value to wildlife.				
461.	The ability to locate and interpret reliable information.				
462.	The ability to identify, classify, and compare plant communities by implementing plant surveying and mapping techniques (e.g. Daubenmire habitat method).				
463.	The ability to identify the successional stage of a plant community.				
464.	The ability to identify the current successional stage of a plant community and predict the wildlife inhabitants.				
465.	The ability to identify wetland plant species and community composition to determine the wetland ecosystem type.				

466.	The ability to manage greentree and moist soil units for target species and species diversity.				
467.	To have knowledge of wetland ecology and management.				
468.	The ability to develop, implement, and manage an adaptive resource habitat management plan.				
469.	The ability to use the internet and computer as tools to aid in biological/habitat management.				
470.	The ability to implement adaptive resource management to evaluate habitat response and future management options.				
471.	To be knowledgeable in forest ecology and management.				
472.	To have knowledge of forest management with emphasis on hardwood management.				
473.	To have knowledge of forest management techniques that pertain to forest dwelling migratory birds.				
474.	The ability to age various wildlife species by locating and implementing species-specific techniques.				
475.	The ability to age deer by dental wear.				
476.	The ability to sex wildlife.				
477.	The ability to trap wildlife.				
478.	The ability to handle wildlife.				
479.	The ability to visually and auditorially identify wildlife.				

480.	The ability to identify wildlife habitat use by wildlife sign.				
481.	The ability to administer proper animal care through animal husbandry techniques and contemporary knowledge of animal welfare issues.				
482.	To have knowledge of plant evolution, which includes ecological, genetic and molecular techniques.				
483.	To have knowledge of animal evolution, which includes ecological, genetic and molecular techniques.				
484.	The ability to merge the management principles of upland, wetland, and aquatic systems to meet wildlife management and biodiversity objectives.				
485.	The ability to apply ecological concepts and models to problems in natural resource and ecosystem management.				
486.	To have knowledge of agrostology for the study of grasses and grassland habitat management.				
487.	To be familiar with localized endangered and threatened species.				
488.	To have knowledge of basic land uses (e.g. aquaculture, crop production, forestry, grazing, wildlife).				
489.	To have knowledge of coniferous ecosystems.				
490.	To have knowledge of fish biology and management.				
491.	To have well grounded training in conservation and protection of biodiversity in management planning				

Physical Science Skills

	Entry-Level Job Skill	Overall Group Mean	Panelist Unique Rating	Importance Rating	Brief Explanation
1.	To have basic knowledge of agronomy (soil characteristics, identification, and productivity).				
2.	The ability to manage the soil for improved environmental and economic productivity.				
3.	The ability to use contemporary soil erosion control techniques within the wildlife management area.				
4.	The ability to understand a soil analysis and determine fertilizer and lime recommendations.				
5.	The ability to identify non-wetland and wetland soil types by soil characteristics, soil maps, and imagery.				
6.	To have a basic knowledge of hydrology.				
7.	The ability to use soil type and topography to assess the hydrologic regime.				
8.	The ability to use surface soils, sub-surface soils, and topography information to assess surface water retention, ground water components, and hydrologic cycles for wildlife management planning.				
9.	The ability to monitor and interpret basic soil and water models to estimate sediment yield, water quality, and water heating.				
10.	To have knowledge of basic				

	water quality monitoring techniques.				
11.	To understand the relationship between soil type, soil fertility, soil hydrology, and plant community to assess ecosystem cycling, productivity, and distribution.				
12.	To understand the relationship between abiotic factors (climate, hydrology, soils) and biotic productivity and diversity.				
13.	The ability to use plant community indices to determine wildlife habitat value.				
14.	To understand the relationships between geography and ecosystems.				
15.	To understand and recognize the relationships between geology and ecosystems of the work area, district and region.				
16.	To recognize and understand the relationship between climate and ecosystems.				
17.	The ability to use basic meteorological monitoring equipment and apply meteorological data for wildlife management planning.				
18.	To recognize and understand the relationship between regionalized weather patterns (daily, seasonal, and long-term patterns) and weather impacts on wildlife.				
19.	To recognize and understand the relationship between elevation and				

	ecosystem diversity.				
20.	The ability to implement and assess appropriate aquatic habitat management techniques.				
21.	The ability to identify, locate, implement, and assess site-specific controls for non-point source pollution to improve water quality.				
22.	The ability to assess current and potential wildlife productivity in upland habitats.				
23.	The ability to determine the suitability of land for agronomic production.				
24.	The ability to implement and manage moist soil unit plant productivity.				
25.	The ability to assess and implement irrigation techniques for land use.				
26.	The ability to apply wildfire risk assessment models to "species at risk".				
27.	The ability to effectively manage prescribed fire to protect air quality.				
28.	To have a basic knowledge of physical and organic chemistry to aid with chemical applications (fertilizer, herbicides, and pesticides).				
29.	To have knowledge of water chemistry and water quality sampling methods.				
30.	The ability to monitor water quality using direct and remote automated equipment for wildlife management planning.				
31.	To have knowledge of organic and biochemistry				

	with specific information on toxicology and environmental health.				
32.	The ability to map and inventory a watershed.				
33.	To have a practical understanding of meteorology				
34.	To have the basic knowledge of organic chemistry.				
35.	To have the basic knowledge of inorganic chemistry.				

Basic Statistic Skills

	Entry-Level Job Skill	Overall Group Mean	Panelist Unique Rating	Importance Rating	Brief Explanation
1.	The ability to use descriptive statistics in the biometric analysis of wildlife phenomenon.				
2.	To have a basic understanding of statistical methods to estimate wildlife populations.				
3.	To be familiar with SAS (Statistical Analysis Systems).				
4.	The ability to understand basic (inferential) statistical concepts.				
5.	The ability to conduct simple analysis with guidance from a scientist or biometrician.				
6.	To be able to read and understand complex research designs.				
7.	To be able to read and understand reports that utilize advanced statistical concepts (ANCOVA, Logistic Regression, etc.)				

8.	The ability to perform routine analysis of raw data using descriptive statistics.				
9.	The ability to understand the assumptions of parametric and non-parametric statistics.				
10.	To understand the application of statistics to wildlife management and research.				
11.	The ability to apply the concepts of accuracy, precision and the scientific method for hypothesis testing.				
12.	The ability to read and interpret scientific articles to understand the study results.				
13.	The ability to use statistics to plan, implement, and assess science-based wildlife management programs (adaptive resource management).				
14.	To understand the effect of sample size on research findings and management outcomes.				
15.	To have knowledge of sampling principles for assessing wildlife populations and wildlife habitat.				
16.	To understand the value of scientific survey sampling in wildlife management.				
17.	The ability to determine the appropriate sample size for wildlife research and adaptive resource management.				
18.	To understand the basic variables and relationships of wildlife population dynamics.				

19.	The ability to recognize a statistically valid sample versus some "neat information".				
20.	The ability to use statistical software packages to record and evaluate data.				
21.	The ability to implement population-adaptive harvest management techniques.				
22.	The ability to statistically analyze population data to determine population growth and recruitment potential.				
23.	The ability to design a sampling survey and analyze the survey data to estimate and monitor population trends.				
24.	The ability to use descriptive statistics to conduct habitat analysis and predict future habitat changes.				
25.	The ability to use inferential statistics to estimate home range.				
26.	The ability to use scientific journal writings to develop a theoretical approach to problem solving.				
27.	To have experience in statistical procedure and data analysis.				

Quantitative Science Skills

	Entry-Level Job Skill	Overall Group Mean	Panelist Unique Rating	Importance Rating	Brief Explanation
1.	To understand the difference between inventorying (what's there), monitoring (what's it doing), and research (why's				

	it doing that).				
2.	The ability to develop, implement, and complete comprehensive wildlife management plans for individual species and groups of species.				
3.	The ability to apply classification and ordination statistics to determine ecological groupings and gradients.				
4.	The ability to implement and complete biodiversity assessments.				
5.	The ability implement risk assessments for "species at risk".				
6.	To be introduced to modeling as a wildlife management tool.				
7.	The ability to apply population models as wildlife management tools (population estimates, indices, life tables and projection, survival, band return, capture-recapture models, sightability models, and minimum viable population analysis).				
8.	To be familiar with general wildlife sampling methods.				
9.	The ability to organize survey sampling and monitoring techniques for wildlife (mammals, birds, reptiles, amphibians, fish, and invertebrates) (e.g. capture, marking, radio telemetry, sexing, ageing).				
10.	The ability to organize survey sampling and monitoring techniques for plants to evaluate wildlife habitat (e.g. imagery; sampling methods -				

	transects (random, stratified, cluster), data (plots, plotless, point intercept).				
11.	The ability to design, implement, and interpret field surveys.				
12.	The ability to estimate animal populations by ground transects.				
13.	The ability to estimate animal populations by aerial transects.				
14.	The ability to plan, implement, and assess the findings of a point-center plot survey.				
15.	The ability to plan, implement, and assess a belt-line transect sampling design.				
16.	The ability to plan, implement, and assess the findings of a plot transect survey.				
17.	The ability to plan, implement, and assess the findings of a browse survey.				
18.	The ability to plan, implement, and assess the findings of a public opinion survey (questionnaires).				
19.	The ability to plan, implement, and assess the findings of random transect sampling.				
20.	The ability to identify the pertinent factors which affect a transect sampling route.				
21.	The ability to identify all plants and plant communities within a sampling point.				
22.	The ability to identify soil types and characteristics				

	within a sampling point.				
23.	The ability to conduct deer surveys using current technology.				
24.	The ability to conduct waterfowl surveys utilizing current technology.				
25.	The ability to conduct shorebird surveys using current technology.				
26.	The ability to conduct woodcock surveys using current technology.				
27.	The ability to conduct mourning dove surveys using current technology.				
28.	The ability to conduct rail surveys using current technology.				
29.	The ability to use, develop, or adapt habitat suitability index models to estimate habitat quality and potential.				
30.	The ability to implement a species-specific population viability analysis.				
31.	To have the basic knowledge and familiarity with modern surface mapping and remote sensing techniques to include computer usage, GIS, GPS, aerial photography, satellite imagery, and cartography to model, monitor, and assess natural resources.				
32.	The ability to estimate and identify surface features through aerial photograph interpretation.				
33.	The ability to use of GIS, GPS, aerial photography, cartography, and map reading for natural resource				

	management planning, monitoring, and assessment.				
34.	The ability to use basic land surveying techniques (e.g. shooting elevations, determining boundaries, setting grade, road construction, logging systems).				
35.	To have knowledge of spatial and temporal landscape analysis.				
36.	To be familiar with various radio telemetry techniques.				
37.	To develop critical quantitative thinking skills by completing math courses through college calculus.				
38.	To develop critical quantitative thinking skills by completing math courses through college algebra.				
39.	To develop critical quantitative thinking skills by completing math courses through college trigonometry.				
40.	To develop critical quantitative thinking skills by completing college physics.				
41.	The ability to use timber inventory sampling techniques that are commonly used in modern forest management.				
42.	The ability to implement variable-plot tree cruising using a Relaskop instrument.				
43.	To have a broad understanding of vegetative sampling techniques commonly used in modern land management activities.				
44.	To have knowledge of the agriculture/wildland				

	interface.				
45.	To have knowledge of the urban/wildland interface.				
46.	To have knowledge of grassland/rangeland inventory techniques.				
47.	To have knowledge of silvicultural biometrics.				
48.	To have basic computational skills.				
49.	The ability to accurately measure and record data.				

Humanity Skills

	Entry-Level Job Skill	Overall Group Mean	Panelist Unique Rating	Importance Rating	Brief Explanation
1.	The ability to understand diverse wildlife values and use that information to design and implement environmental education and/or outreach programs.				
2.	The ability to understand and apply human social, demographic, economic, and political implications as to related wildlife law, sustainable resources, management, harvest, conservation, preservation, and assessment.				
3.	The ability understand public perception of wildlife and associated habitats.				
4.	To understand and appreciate diverse human cultures and associated wildlife value systems.				
5.	The ability to understand historical and contemporary roles of society in wildlife management.				
6.	The ability to understand				

	historical and contemporary roles of society in forest management.				
7.	The ability to recognize human need for outdoor recreation and to understand the apparent implications if that need is denied or suppressed (conflict management).				
8.	The ability to recognize the history, role, and importance of consumptive wildlife use (hunting, fishing, and trapping) as a wildlife conservation/management tool.				
9.	The ability to understand the traditions, culture, and heritage surrounding consumptive values such as hunting, fishing, and trapping.				
10.	The ability to recognize the social implications of wildlife management actions and pre-planning responses to questions and challenges made by those who do not understand or support hunting as a wildlife management tool.				
11.	The ability to recognize, understand, and appreciate diverse cultural perspectives regarding wildlife values (stakeholder diversity).				
12.	The ability to recognize the value of human diversity in the workplace.				
13.	The ability to work professionally in order to be accepted as professionals by future society.				
14.	The ability to recognize and understand diverse cultural				

	natural resource values.				
15.	The ability to understand the need for social acceptance of consumptive natural resource use (hunting, trapping, and fishing).				
16.	The ability to relate wildlife or habitat trends to human dynamics.				
17.	To have a foundation of wildlife conservation and land management history.				
18.	The ability to understand that changing U.S. demographics will impact future wildlife management.				
19.	To recognize the impact of giving animals' human traits by TV and other medias, which will affect society's acceptance of consumptive wildlife use (hunting and trapping).				
20.	The ability to apply real world economics and capitalism in wildlife management.				
21.	The ability to apply macro and microeconomics concepts to wildlife management.				
22.	To have knowledge of political science.				
23.	The ability to recognize how diverse social values affect wildlife management decisions.				
24.	To have an understanding of conservation biology				
25.	The ability to develop and maintain partnerships in wildlife management.				
26.	The ability to function as a well-rounded member of society.				

27.	The ability to understand "anti-group stakeholders" (e.g. PETA) and their perspectives.				
28.	The ability to understand private landowner needs and their relationship to wildlife and land management.				
29.	The ability to develop personal environmental ethics and a resource philosophy.				
30.	To have knowledge of political and social history at the local, state, and national level, which involve wildlife management.				
31.	To be familiar with global historic and contemporary wildlife issues.				
32.	The ability to locate and retrieve reliable wildlife information from the library and internet resources.				

Communication Skills

	Entry-Level Job Skill	Overall Group Mean	Panelist Unique Rating	Importance Rating	Brief Explanation
1.	The ability to be an effective public speaker.				
2.	The ability to professionally present information to a group of peers.				
3.	The ability to use software programs (e.g. PowerPoint) to construct one-on-one, lay-groups, professional, and web-based presentations to reach a diversity of audiences.				
4.	The ability to avoid or resolve potential human				

	conflict situations with the most effective and appropriate conflict resolution methods.				
5.	The ability to use informed consent to effectively accomplish the mission, when consensus development is ineffective.				
6.	The ability to resolve conflict through consensus building.				
7.	The ability to skillfully communicate with diverse groups and individuals.				
8.	The ability to write a simple technical report.				
9.	The ability to professionally and effectively communicate one-on-one at any level of understanding (technical and lay person).				
10.	The ability to explain complex issues to layman stakeholders.				
11.	The ability to effectively present a professional presentation to a large audience.				
12.	The ability to effectively manage diverse visitors or user groups.				
13.	The ability to speak to a group of people in a variety of forms and formats.				
14.	The ability to interact well with stakeholder groups.				
15.	The ability to effectively manage and interact with diverse staff personnel.				
16.	The ability to deal with and discuss controversial issues in an hostile environment.				
17.	The ability of the natural resource manager to effectively work with				

	stakeholders through contemporary public relation practices.				
18.	The ability to articulate natural resource knowledge and management intent to the public in an understandable manner, which requires understanding the audience's perspective.				
19.	The ability to communicate points convincingly to the public in print.				
20.	The ability to write effectively for various audiences.				
21.	The ability to communicate scientific information to managers and scientists with sound technical writing skills.				
22.	The ability to communicate through written professional correspondence.				
23.	The ability to write plans, reports, technical papers, and other documents using good grammar, punctuation, and techniques.				
24.	The ability to effectively communicate ideas and technical information through popular publications.				
25.	The ability to speak with the media and get your most important message across in a 30 second sound bite.				
26.	The ability to summarize and effectively communicate information through charts and figures for presentation and publication.				
27.	The ability to be an effective and responsive				

	active listener.				
28.	The ability to develop and maintain interpersonal relationships.				
29.	The ability to be a team player and recognize the role of effective teamwork in organizations.				
30.	The ability to lead and follow as the situation warrants.				
31.	The ability to effectively network and interact with diversified groups (e.g. public, private, academic, media).				
32.	The ability to keep a positive, friendly, and outgoing attitude.				
33.	The ability to use specific knowledge to interact, influence, and communicate with community groups (action leaders, opinion leaders, etc.).				
34.	The ability to write grants.				
35.	The ability to communicate through good telephone etiquette.				
36.	The ability to interact, communicate, and respond with others on a daily basis to facilitate effective "win-win" situation.				
37.	The ability to use marketing principles and effectively communicate ideas through educational and awareness programs to stakeholders.				
38.	The ability to edit and critically review communication media (manuscripts and presentations).				
39.	The ability to work with difficult people.				

40.	The ability to email correspondence.				
41.	The ability to navigate and locate information on the internet.				
42.	The ability to communicate using computer technology.				

Policy Administration Skills

	Entry-Level Job Skill	Overall Group Mean	Panelist Unique Rating	Importance Rating	Brief Explanation
1.	The ability to understand the agency mission statement and the employee's contribution to accomplish the agency mission.				
2.	The ability to possess a working knowledge of local, state, and national political and legislative processes to effectively accomplish organizational goals.				
3.	The ability to apply basic knowledge of business administration and management in the workplace.				
4.	The ability to apply basic budgeting and accounting skills in the workplace.				
5.	The ability to effectively understand workplace policy regarding employee supervision, hiring, firing, EEO, and budgeting.				
6.	The ability to apply sensitivity training in the workplace.				
7.	The ability to understand the various roles and responsibilities of federal and state government at the				

	executive, legislative, and judicial levels.				
8.	To possess the basic knowledge of the origin and relevance of wildlife regulations.				
9.	The ability to understand how state legislative processes impact the agency's mission.				
10.	The ability to understand how the federal legislative processes impacts an agency's mission.				
11.	The ability to formulate public use regulations.				
12.	The ability to interpret and apply laws and policy to agency natural resource programs.				
13.	The ability to interpret and apply regulation and policy in practical situations.				
14.	The ability to recognize the differences between law, policy, and guidelines.				
15.	The ability to understand the structure and function of state agency administrations.				
16.	The ability to understand the structure and function of federal agency administrations.				
17.	The ability to understand the roles and responsibilities of various local, state, and federal agencies.				
18.	The ability to identify key governmental administrators that formulate wildlife policy.				
19.	The ability to electronically and manually locate and understand local, state, and				

	federal regulations that pertain to wildlife management.				
20.	The ability to reference legal codes that provide the mandate for agency administration and operation.				
21.	To know the purpose and fundamentals of major natural resource laws (Clean Water Act, National Environmental Policy Act, Endangered Species Act, Lacey Act, Migratory Bird Treaty Act, etc.).				
22.	The ability to understand how federal and state threatened/endangered species laws relate to the individual's workplace, agencies, and landowners.				
23.	To understand how federal, state, and other organizations classify species.				
24.	The ability to integrate the needs of wildlife, environment, and humans with natural resource management.				
25.	To be exposed to the role of government regulations and the importance of compliance.				
26.	The ability to work within existing laws, regulations, and policies.				
27.	To have basic knowledge of water rights law.				
28.	The ability to recognize and understand state game laws.				
29.	To have basic knowledge of the wildlife profession, prominent wildlife leaders, and the history of wildlife legislation in the U.S.A.				

	(wildlife profession, Aldo Leopold, Pittman-Robertson, Lacy, ESA, etc.).				
30.	To have basic knowledge of business law.				
31.	The ability to understand risk analysis and management.				
32.	The ability to understand how science informs policy and decision makers.				
33.	To have basic knowledge in law enforcement and the wildife agent's duties.				
34.	To have basic knowledge of major land programs affecting wildife.				
35.	To know the agencies and CEO's that affect state and federal wildlife programs.				
36.	To have knowledge and understanding of non-government organizations in the natural resource field and their goals.				
37.	To have basic knowledge and understanding of wetland regulations (Clean Water Act, Section 404, Food securities Act, Wetland Reserve Program).				
38.	To have knowledge of major case histories involving controversial resource issues such as the Monogahela decision, Everglades, Columbia River dams, Chesapeake Bay pesticides, Northwest old growth forests and Northwest Forest Plan by the Clinton Administration.				

Practical Daily Skills

	Entry-Level Job Skill	Overall Group Mean	Panelist Unique Rating	Importance Rating	Brief Explanation
1.	To be defensive driving certified.				
2.	The ability to perform routine service and emergency repair of vehicles and equipment.				
3.	The ability to operate a vehicle with a standard or automatic transmission.				
4.	The ability to maneuver a 4-wheel drive vehicle with a standard or automatic transmission.				
5.	The ability to maneuver a vehicle and trailer.				
6.	To have basic knowledge and use of various farm equipment and implements.				
7.	To have basic knowledge and use of heavy equipment.				
8.	To have knowledge of different types of hunting equipment.				
9.	To have knowledge of different types of fishing equipment.				
10.	The ability to operate a motorized boat as indicated by training certification.				
11.	The ability to operate an ATV as indicated by training certification.				
12.	To have knowledge of and safely use firearms.				
13.	To be first aid and CPR qualified.				
14.	To have basic camping and outdoor survival skills.				
15.	The ability to navigate by GPS, map, and compass.				
16.	The ability to read and follow blueprints and shop				

	drawings.				
17.	The ability to use computers for word processing, developing PowerPoint presentations, canned programs (Program Mark and Program Distance), database management, and statistical packages.				
18.	The basic ability for repair and maintenance of computers (troubleshooting for repair and maintenance).				
19.	The ability to use Microsoft Office Suite for word-processing, presenting, database management, and data analysis.				
20.	The ability to use the scientific method for basic research and problem solving in wildlife management.				
21.	The ability and willingness to learn new "things" in everyday life (life-long learning through reading, conferences, etc.)				
22.	The ability to develop and organize annual and weekly work plans.				
23.	The ability to fabricate metal (welding/cutting operations).				
24.	The ability to be an accountable and dependable self-starter who can work independently, efficiently, and safely with minimal supervision in all settings (individual, group, office, laboratory, field).				
25.	The ability to communicate by radio.				
26.	The ability to document information via camera operation.				

27.	To have basic knowledge and basic abilities to use hand tools for carpentry, electrical, plumbing, metal fabrication, and general maintenance.				
28.	To have basic knowledge of construction.				
29.	The ability to safely operate a chainsaw and properly fell a tree.				
30.	The demonstrated ability to tolerate adverse field conditions and excel under extended duty in the field.				
31.	The ability to apply coursework to a field setting for writing a management plan and report writing.				
32.	The ability to identify potential ecological problems in the field.				
33.	The ability to establish credibility with colleagues and the public.				
34.	The ability to understand habitat and population manipulation as wildlife management tools.				
35.	The ability to be an ethical wildlife manager.				
36.	The ability to develop and possess good observational skills.				
37.	The ability to indicate wildife work experience on your resume (volunteer, internship, summer employment).				
38.	The ability to balance family and work.				
39.	The ability to maintain a good attitude. Regardless of training, attitude is the best predictor of success. Individuals who are fair and				

	honest with others are successful. Even if an individual, with only average intelligence and training, who can effectively deal with others will succeed better than most others.				
40.	The ability to understand the basics of fire and fire fighting (wildland fire training/certification: Federal s130/190)				
41.	The ability to operate hand-held computers.				
42.	The ability to locate and identify potential employment opportunities.				
43.	The ability to effectively manage relationships with lessees (e.g. hunting clubs).				
44.	The ability to manage time (time management).				
45.	The ability to recognize and accept goals of the employer.				
46.	The ability to work with management and research personnel of the public and private sectors.				
47.	The ability to install, maintain, and use basic field sampling equipment.				
48.	The ability to follow basic laboratory procedures.				
49.	The ability to navigate in a forest landscape using maps/photos.				
50.	To have experience in small aircraft and helicopters				
51.	The ability to use a winch on a vehicle.				
52.	To have experience with wetsuits/snorkeling.				
53.	To have experience in fish shocking equipment.				

54.	To have grounded training in conservation ethics issues.				

APPENDIX N

FIRST EMAIL REMINDER OF ROUND ONE DUE DATE

December 26, 2003

Dear Panelist,

Please note the following. Several pilot checks were run on the instrument hotlink. However, my computer was upgraded to Microsoft Office 2003. It was not until the Round One instrument was transmitted that it was realized the hotlink functioned differently that originally designed.

In order to access the Round One instrument, click control and left click the mouse simultaneously and the instrument will one.

For your convenience, the hotlink is attached below.

Have a prosperous New Year,

Billy

http://www.mcneese.edu/colleges/sci/deptag/round_one_instrument.htm

APPENDIX O

SECOND EMAIL REMINDER FOR ROUND ONE DUE DATE

December 29, 2003

Dear Panelist,

On Monday, December 29^{th}, McNeese State University experienced a power outage. Please note the attached hotlink. A pilot test has been run on the hotlink, and it is working.

Sorry for the inconvenience,

Billy

http://www.mcneese.edu/colleges/sci/deptag/round_one_instrument.htm

APPENDIX P

THIRD EMAIL REMINDER FOR ROUND ONE DUE DATE

January 6, 2004

Dear Panelist,

Just a short reminder. Please remember that January 9th is the due date for the first instrument. We have already received several responses and have constructed the initial database. Your opinions are important to this research effort.

Thank you for your assistance,

Billy

http://www.mcneese.edu/colleges/sci/deptag/round_one_instrument.htm

APPENDIX Q

FOURTH EMAIL REMINDER OF FIRST ROUND DUE DATE

January 12, 2004

Dear Panelist,

The due date for the Round One instrument has been extended. Please submit your Round One instrument by Friday, January 16, 2004. Most Round One data has been received. There is redundancy within the database; however, each panelist brings either a unique outlook to an entry-level job skill item or each panelist adds a new item.

Your opinions are important to this research. Although if your time schedule does not allow you to complete the first round item by Friday, please let me know so that I may conclude the database and construct the Round Two instrument. In the event that you cannot complete the first round survey instrument, you will be retained as a Panelist and you will receive the Round Two instrument.

Thank you for your prompt reply. If I may be of further service, please email to bdelany@mcneese.edu. For your convenience please note the Round One Instrument below.

http://www.mcneese.edu/colleges/sci/deptag/round_one_instrument.htm

Billy

APPENDIX R

EMAIL TRANSMISSION OF TECHNICAL FAILURE

January 23, 2004

Dear Panelist,

Due to logistical and technical failure (my computer losing its mind), our research is set back. You should be receiving the second instrument in a couple of weeks.

Luckily, my computer was backed-up in triplicate. O' the wonders of modern technology.

Sorry for any inconvenience,

Billy

APPENDIX S

ROUND TWO FIRST EMAIL NON-RESPONSE REMINDER

February 21, 2004

Dear Panelist,

Due to our varied and rigorous work schedules, the due date has been extended to Friday, February 27th. Thank you.

Happy Mardi Gras,

Billy

APPENDIX T

ROUND TWO SECOND EMAIL NON-RESPONSE REMINDER

February 27, 2004

Dear Panelist,

We noticed that we were missing your data. If you have had submission issues, we have attached the instruments for direct submission to us.

I do realize that your time is valuable. Your time is also valuable to this study, and your experience should be a part of this study.

Attached for your convenience are the 8 instruments. The instruments are in Microsoft Word and are form protected. If you will complete each instrument and email back to me, I will enter the data into the database.

The final due date is Monday, March 8th at 12pm.

Thank you for your assistance in this matter.

Sincerely,

Billy

APPENDIX U

SUMMARY TABLE OF ENTRY-LEVEL JOB SKILLS NEEDED BY WILDLIFE MANAGEMENT PROFESSIONALS AS PERCEIVED BY WILDLIFE MANAGEMENT EXPERTS IN A ROUND TWO DELPHI SURVEY

	Item	Median[a]	X^b	SD
1	To have a strong foundation in wildlife management principles and techniques.	5	4.94	0.25
2	The ability to be an ethical wildlife manager.	5	4.94	0.25
3	To have a sound foundation in biology.	5	4.88	0.34
4	The ability to skillfully communicate with diverse groups and individuals.	5	4.88	0.34
5	To have a sound understanding of ecological principles and concepts of the relationships between plants, animals, and the environment.	5	4.88	0.42
6	The ability to accurately measure and record data.	5	4.88	0.42
7	The ability to establish credibility with colleagues and the public.	5	4.84	0.37
8	The ability to maintain a good attitude. Regardless of training, attitude is the best predictor of success. Individuals who are fair and honest with others are successful. Even if an individual, with only average intelligence and training, who can effectively deal with others, will succeed better than most others.	5	4.84	0.37
9	The ability to be an accountable and dependable self-starter who can work independently, efficiently, and safely with minimal supervision in all settings (individual, group, office, laboratory, field).	5	4.84	0.45
10	The ability to develop and possess good observational skills.	5	4.84	0.45
11	To be familiar with general wildlife sampling methods.	5	4.81	0.4

12	The ability and willingness to learn new "things" in everyday life (life-long learning through reading, conferences, etc.)	5	4.81	0.4
13	The ability to balance family and work.	5	4.81	0.4
14	The ability to understand habitat and population manipulation as wildlife management tools.	5	4.81	0.47
15	The ability to locate and interpret reliable information.	5	4.81	0.59
16	The ability to write plans, reports, technical papers, and other documents using good grammar, punctuation, and techniques.	5	4.81	0.59
17	The ability to manage time (time management).	5	4.78	0.49
18	The ability to write a simple technical report.	5	4.78	0.61
19	The ability to develop personal environmental ethics and a resource philosophy.	5	4.75	0.57
20	The ability to professionally and effectively communicate one-on-one at any level of understanding (technical and lay person).	5	4.75	0.62
21	The ability to keep a positive, friendly, and outgoing attitude.	5	4.75	0.62
22	The ability to recognize and accept goals of the employer.	5	4.72	0.52
23	The ability to work within existing laws, regulations, and policies.	5	4.72	0.58
24	The ability to use computers for word processing, developing PowerPoint presentations, canned programs (Program Mark and Program Distance), database management, and statistical packages.	5	4.72	0.58
25	To have a sound foundation of wildlife ecological principles and processes.	5	4.72	0.63

26	The ability to read and interpret scientific articles to understand the study results.	5	4.69	0.59
27	The ability to locate and retrieve reliable wildlife information from the library and internet resources.	5	4.69	0.59
28	The ability to professionally present information to a group of peers.	5	4.66	0.60
29	The ability to develop and maintain interpersonal relationships.	5	4.66	0.75
30	The ability to be a team player and recognize the role of effective teamwork in organizations.	5	4.66	0.75
31	To understand the need for conserving and protecting biodiversity in management planning.	5	4.65	0.61
32	The ability to function as a well-rounded member of society.	5	4.63	0.61
33	The ability to understand private landowner needs and their relationship to wildlife and land management.	5	4.63	0.61
34	To understand the application of statistics to wildlife management and research.	5	4.63	0.66
35	To be knowledgeable of wildlife habitat management principles, tools, and techniques.	5	4.63	0.75
36	The ability to locate, read, and comprehend reliable life history knowledge of mammals, birds, reptiles, amphibians, fish, insects, and other invertebrates.	5	4.59	0.61
37	The ability to apply coursework to a field setting for writing a management plan and report writing.	5	4.59	0.61
38	The ability to work with management and research personnel of the public and private sectors.	5	4.59	0.61
39	To have basic computational skills.	5	4.59	0.67
40	The ability to explain complex issues to layman stakeholders.	5	4.59	0.67

41	The ability to develop and maintain partnerships in wildlife management.	5	4.59	0.71
42	The ability to lead and follow as the situation warrants.	5	4.59	0.84
43	The ability to interact well with stakeholder groups.	5	4.56	0.72
44	To have a basic understanding of ecology (population, community, and ecosystem).	5	4.56	0.76
45	The ability to be an effective and responsive active listener.	5	4.56	0.80
46	The ability to understand the agency mission statement and the employee's contribution to accomplish the agency mission.	5	4.53	0.67
47	The ability to communicate using computer technology.	5	4.53	0.72
48	The ability to write effectively for various audiences.	5	4.53	0.76
49	The ability to communicate through written professional correspondence.	5	4.53	0.76
50	The ability to identify potential ecological problems in the field.	5	4.50	0.57
51	To have knowledge of sampling principles for assessing wildlife populations and wildlife habitat.	5	4.50	0.67
52	The ability to be an effective public speaker.	5	4.50	0.72
53	The ability to effectively manage and interact with diverse staff personnel.	5	4.50	0.72
54	The ability to effectively network and interact with diversified groups (e.g. public, private, academic, media).	5	4.50	0.72
55	The ability to use software programs (e.g. PowerPoint) to construct one-on-one, lay-groups, professional, and web-based presentations to reach a diversity of audiences.	5	4.47	0.67
56	To understand the value of scientific survey sampling in wildlife management.	5	4.47	0.72

57	To understand the difference between inventorying (what's there), monitoring (what's it doing), and research (why's it doing that).	5	4.47	0.72
58	The ability to integrate the needs of wildlife, environment, and humans with natural resource management.	5	4.47	0.76
59	The ability to use the internet and computer as tools to aid in biological/habitat management.	5	4.47	0.80
60	The ability to use the scientific method for basic research and problem solving in wildlife management.	5	4.44	0.76
61	The ability to articulate natural resource knowledge and management intent to the public in an understandable manner, which requires understanding the audience's perspective.	5	4.44	0.84
62	To have a basic understanding of statistical methods to estimate wildlife populations.	5	4.41	0.80
63	To have a foundation of wildlife conservation and land management history.	5	4.41	0.80
64	The ability to work professionally in order to be accepted as professionals by future society.	5	4.41	0.84
65	The ability to communicate through good telephone etiquette.	5	4.41	0.98
66	The ability to recognize a statistically valid sample versus some "neat information."	5	4.38	0.75
67	The ability to speak to a group of people in a variety of forms and formats.	5	4.38	0.79
68	To know the purpose and fundamentals of major natural resource laws (Clean Water Act, National Environmental Policy Act, Endangered Species Act, Lacey Act, Migratory Bird Treaty Act, etc.).	5	4.38	0.79

69	The ability to implement and assess the impacts of management on target and non-target species.	5	4.38	0.83
70	The ability to recognize and understand state game laws.	5	4.38	0.83
71	The ability to conduct simple analysis with guidance from a scientist or biometrician.	5	4.38	0.87
72	The ability to navigate and locate information on the internet.	5	4.38	0.87
73	The ability to interact, communicate, and respond with others on a daily basis to facilitate effective "win-win" situation.	5	4.38	0.91
74	The ability to develop, implement, and complete comprehensive wildlife management plans for individual species and groups of species.	4	4.34	0.70
75	The ability to communicate scientific information to managers and scientists with sound technical writing skills.	4	4.34	0.75
76	To have a broad understanding of vegetative sampling techniques commonly used in modern land management activities.	4.5	4.34	0.79
77	The ability to recognize the history, role, and importance of consumptive wildlife use (hunting, fishing, and trapping) as a wildlife conservation/management tool.	5	4.34	0.83
78	The ability to deal with and discuss controversial issues in an hostile environment.	5	4.34	0.83
79	To have basic knowledge of forest management practices.	5	4.34	0.87
80	The ability to use GIS, GPS, aerial photography, cartography, and map reading for natural resource management planning, monitoring, and assessment.	4	4.31	0.69

81	The ability to develop and organize annual and weekly work plans.	5	4.31	0.86
82	The ability to email correspondence.	5	4.31	1.03
83	The ability to determine and identify species-specific habitat requirements.	4	4.28	0.73
84	To have basic knowledge of the wildlife profession, prominent wildlife leaders, and the history of wildlife legislation in the U.S.A. (wildlife profession, Aldo Leopold, Pittman-Robertson, Lacy, ESA, etc.).	4	4.28	0.73
85	The ability to understand public perception of wildlife and associated habitats.	4	4.28	0.77
86	The ability to implement and assess habitat management techniques on target and non-target species habitat.	4	4.28	0.81
87	The ability to work with difficult people.	4	4.28	0.81
88	To have a sound foundation of plant ecological principles and processes.	4.5	4.28	0.85
89	To have knowledge of basic land uses (e.g. aquaculture, crop production, forestry, grazing, wildlife).	5	4.28	0.92
90	The ability to avoid or resolve potential human conflict situations with the most effective and appropriate conflict resolution methods.	4	4.25	0.8
91	To understand the effect of sample size on research findings and management outcomes.	4	4.25	0.84
92	The ability to navigate by GPS, map, and compass.	4.5	4.25	0.88
93	The ability to utilize man-made practices as useful ecological management tools (grazing, prescribed fire, herbicide application, logging, agronomic practices, etc).	4.5	4.25	0.92
94	The demonstrated ability to tolerate adverse field conditions and excel under extended duty in the field.	4.5	4.25	0.92

95	To understand wildlife harvest management concepts and implications when developing management plans.	5	4.25	0.95
96	The ability to organize survey sampling and monitoring techniques for plants to evaluate wildlife habitat (e.g. imagery; sampling methods - transects (random, stratified, cluster), data (plots, plotless, point intercept).	4	4.22	0.55
97	The ability to use plant community indices to determine wildlife habitat value.	4	4.22	0.660
98	The ability to organize survey sampling and monitoring techniques for wildlife (mammals, birds, reptiles, amphibians, fish, and invertebrates) (e.g. capture, marking, radio telemetry, sexing, ageing).	4	4.22	0.66
99	The ability to understand the need for social acceptance of consumptive natural resource use (hunting, trapping, and fishing).	4	4.22	0.79
100	The ability to recognize the differences between law, policy, and guidelines.	4	4.22	0.87
101	The ability to understand how federal and state threatened/endangered species laws relate to the individual's workplace, agencies, and landowners.	4	4.22	0.87
102	To be knowledgeable in forest ecology and management.	5	4.22	0.94
103	The ability to navigate in a forest landscape using maps/photos.	5	4.22	1.04
104	To have knowledge of techniques for estimating animal density and diversity.	4	4.19	0.64
105	The ability to design, implement, and interpret field surveys.	4	4.19	0.74
106	To have basic knowledge of major land programs affecting wildlife.	4	4.19	0.78
107	To have a sound foundation in botany.	4	4.19	0.86
108	The ability to apply the concepts of accuracy, precision and the scientific method for hypothesis testing.	4	4.19	0.86

109	The ability to determine and identify species specific limiting factors.	4	4.19	0.90
110	To be familiar with localized endangered and threatened species.	4.5	4.19	1.03
111	The ability to understand basic (inferential) statistical concepts.	4.5	4.19	1.06
112	The ability to interpret and apply regulation and policy in practical situations.	4	4.16	0.77
113	To have a working understanding of population dynamic principles.	4	4.16	0.81
114	The ability to locate species-specific plant life history and determine plant species value to wildlife.	4	4.16	0.81
115	To understand the basic variables and relationships of wildlife population dynamics.	4	4.16	0.81
116	To have an understanding of conservation biology	4	4.16	0.88
117	The ability to communicate points convincingly to the public in print.	4	4.16	0.88
118	The ability to summarize and effectively communicate information through charts and figures for presentation and publication.	4	4.16	0.95
119	The ability to indicate wildlife work experience on your resume (volunteer, internship, summer employment).	4	4.13	0.79
120	The ability to operate a vehicle with a standard or automatic transmission.	4	4.13	0.94
121	To have knowledge of wetland ecology and management.	4.5	4.13	1.07
122	To have a working knowledge for ageing, sexing, trapping, capturing, handling, marking, and radio telemetry tracking of wildlife.	4	4.09	0.86

123	To have the basic knowledge and familiarity with modern surface mapping and remote sensing techniques to include computer usage, GIS, GPS, aerial photography, satellite imagery, and cartography to model, monitor, and assess natural resources.	4	4.09	0.89
124	The ability to recognize variables and relationships within an ecosystem (plant-animal-environment).	4	4.09	0.93
125	The ability to perform routine analysis of raw data using descriptive statistics.	4	4.09	1.03
126	The ability to identify and utilize state-of-the-art wildlife management techniques for major game species.	4	4.06	0.88
127	The ability to recognize the social implications of wildlife management actions and pre-planning responses to questions and challenges made by those who do not understand or support hunting as a wildlife management tool.	4	4.06	0.88
128	The ability to effectively manage diverse visitors or user groups.	4	4.06	0.88
129	The ability to recognize, understand, and appreciate diverse cultural perspectives regarding wildlife values (stakeholder diversity).	4	4.06	0.91
130	The ability to maneuver a 4-wheel drive vehicle with a standard or automatic transmission.	4	4.06	0.95
131	The ability to use specific knowledge to interact, influence, and communicate with community groups (action leaders, opinion leaders, etc.).	4	4.06	1.01
132	To have the basic understanding of landscape ecology for ecosystem restoration and management planning.	4	4.06	1.08
133	To have knowledge of all basic wildlife courses.	4	4.06	1.11
134	To have a sound foundation of zoology.	4	4.03	0.86

135	The ability to recognize how diverse social values affect wildlife management decisions.	4	4.03	0.86
136	The ability to effectively present a professional presentation to a large audience.	4	4.03	0.93
137	To have basic knowledge and understanding of wetland regulations (Clean Water Act, Section 404, Food Securities Act, Wetland Reserve Program).	4	4.03	0.93
138	The ability to apply ecological concepts and models to problems in natural resource and ecosystem management.	4	4.03	0.97
139	The ability to understand that changing U.S. demographics will impact future wildlife management.	4	4.03	0.97
140	To have knowledge of the agriculture/wildland interface.	4	4.03	1.03
141	To have basic knowledge of ornithology.	4	4.00	0.72
142	The ability to install, maintain, and use basic field sampling equipment.	4	4.00	0.8
143	The ability to recognize and understand diverse cultural natural resource values.	4	4.00	0.88
144	The ability to identify the current successional stage of a plant community and predict the wildlife inhabitants.	4	4.00	0.92
145	The ability to recognize the value of human diversity in the workplace.	4	4.00	0.92
146	The ability to identify the successional stage of a plant community.	4	4.00	0.98
147	To have knowledge of the urban/wildland interface.	4	4.00	1.05
148	To have basic knowledge of mammology.	4	3.97	0.69
149	The ability to resolve conflict through consensus building.	4	3.97	0.82
150	The ability to visually and auditorially identify wildlife.	4	3.97	0.86

151	The ability to recognize human need for outdoor recreation and to understand the apparent implications if that need is denied or suppressed (conflict management).	4	3.97	0.86
152	The ability of the natural resource manager to effectively work with stakeholders through contemporary public relation practices.	4	3.97	1.03
153	The ability to effectively understand workplace policy regarding employee supervision, hiring, firing, EEO, and budgeting.	4	3.97	1.03
154	To have knowledge of techniques for estimating plant density and diversity.	4	3.94	0.67
155	To possess the basic knowledge of the origin and relevance of wildlife regulations.	4	3.94	0.84
156	The ability to understand the roles and responsibilities of various local, state, and federal agencies.	4	3.94	0.84
157	The ability to electronically and manually locate and understand local, state, and federal regulations that pertain to wildlife management.	4	3.94	0.88
158	The ability to identify and utilize specific state-of-the-art wildlife management methods and techniques for high profile non-game species.	4	3.94	0.91
159	The ability to implement forest management and silvicultural practices for wildlife habitat restoration, maintenance, and management.	4	3.94	0.95
160	The ability to use descriptive statistics in the biometric analysis of wildlife phenomenon.	4	3.94	1.05
161	The ability to use statistics to plan, implement, and assess science-based wildlife management programs (adaptive resource management).	4	3.91	0.69

162	The ability to understand "anti-group stakeholders" (e.g. PETA) and their perspectives.	4	3.91	0.82
163	To have knowledge and understanding of non-government organizations in the natural resource field and their goals.	4	3.91	0.82
164	The ability to merge the management principles of upland, wetland, and aquatic systems to meet wildlife management and biodiversity objectives.	4	3.91	0.93
165	To have experience in statistical procedure and data analysis.	4	3.91	0.96
166	To be exposed to the role of government regulations and the importance of compliance.	4	3.91	1.00
167	The ability to sex wildlife.	4	3.91	1.12
168	To understand the relationship between abiotic factors (climate, hydrology, soils) and biotic productivity and diversity.	4	3.88	0.83
169	The ability to identify wildlife habitat use by wildlife sign.	4	3.88	0.91
170	To understand the importance of indicator species habitat requirements when preparing and implementing management strategies.	4	3.88	0.94
171	To have the basic understanding of wildland fire ecology.	4	3.88	0.98
172	The ability to use Microsoft Office Suite for word-processing, presenting, database management, and data analysis.	4	3.88	1.10
173	The ability to effectively communicate ideas and technical information through popular publications.	4	3.84	0.88
174	The ability to implement adaptive resource management to evaluate habitat response and future management options.	4	3.84	0.92
175	The ability to understand how science informs policy and decision makers.	4	3.84	0.95

176	The ability to identify mammals, birds, reptiles, amphibians, and fish to species; insects to order; other invertebrates to phyla and order through the use of a key.	4	3.84	1.08
177	To understand and appreciate diverse human cultures and associated wildlife value systems.	4	3.84	1.11
178	To recognize the impact of giving animals' human traits by TV and other medias, which will affect society's acceptance of consumptive wildlife use (hunting and trapping).	4	3.84	1.11
179	To have knowledge of the factors affecting wildlife growth, reproduction, fitness, and survival including knowledge of diseases and genetics.	4	3.81	0.69
180	To be introduced to modeling as a wildlife management tool.	4	3.81	0.74
181	To have knowledge of political and social history at the local, state, and national level, which involve wildlife management.	4	3.81	0.86
182	To have a basic knowledge of hydrology.	4	3.81	0.97
183	To develop critical quantitative thinking skills by completing math courses through college algebra.	4	3.81	1.06
184	The ability to identify wetland plant species and community composition to determine the wetland ecosystem type.	4	3.78	0.79
185	The ability to understand historical and contemporary roles of society in wildlife management.	4	3.78	0.79
186	The ability to use informed consent to effectively accomplish the mission, when consensus development is ineffective.	4	3.78	0.83
187	The ability to estimate and identify surface features through aerial photograph interpretation.	4	3.78	0.87

188	The ability to apply real world economics and capitalism in wildlife management.	4	3.78	0.94
189	The ability to maneuver a vehicle and trailer.	4	3.78	1.01
190	The ability to relate wildlife or habitat trends to human dynamics.	4	3.78	1.04
191	The ability to interpret and apply laws and policy to agency natural resource programs.	4	3.78	1.04
192	The ability to understand how the federal legislative processes impacts an agency's mission.	4	3.75	0.92
193	The ability to handle wildlife.	4	3.75	0.98
194	The ability to use statistical software packages to record and evaluate data.	4	3.75	1.05
195	To have knowledge of and safely use firearms.	4	3.75	1.27
196	The ability to determine and identify species-specific predator/prey relationships.	4	3.72	0.89
197	The ability to possess a working knowledge of local, state, and national political and legislative processes to effectively accomplish organizational goals.	4	3.72	0.92
198	To have basic knowledge and skills of dendrology (keying, collecting, preserving, and ageing plants).	4	3.72	0.99
199	The ability to key-out an avian species.	4	3.72	1.02
200	To understand how federal, state, and other organizations classify species.	4	3.72	1.05
201	To have knowledge of waterfowl management techniques.	4	3.72	1.08
202	The ability to understand the various roles and responsibilities of federal and state government at the executive, legislative, and judicial levels.	4	3.69	0.74

203	The ability to apply population models as wildlife management tools (population estimates, indices, life tables and projection, survival, band return, capture-recapture models, sightability models, and minimum viable population analysis).	4	3.69	0.78
204	The ability to determine the appropriate sample size for wildlife research and adaptive resource management.	4	3.69	0.90
205	The ability to use descriptive statistics to conduct habitat analysis and predict future habitat changes.	4	3.69	0.93
206	To have knowledge of forest management techniques that pertain to forest dwelling migratory birds.	4	3.69	0.97
207	The ability to develop, implement, and manage an adaptive resource habitat management plan.	4	3.69	1.00
208	The ability to understand how state legislative processes impact the agency's mission.	4	3.69	1.06
209	The ability to edit and critically review communication media (manuscripts and presentations).	3.5	3.69	1.15
210	The ability to use contemporary soil erosion control techniques within the wildlife management area.	4	3.66	0.94
211	The ability to implement and assess appropriate aquatic habitat management techniques.	4	3.66	0.97
212	The ability to understand the structure and function of federal agency administrations.	4	3.66	1.00
213	The ability to design a sampling survey and analyze the survey data to estimate and monitor population trends.	4	3.66	1.04
214	The ability to locate and identify potential employment opportunities.	3.5	3.66	1.12
215	The ability to implement and complete biodiversity assessments.	4	3.63	0.79

216	The ability to identify the pertinent factors which affect a transect sampling route.	4	3.63	0.83
217	The ability to key-out regional and national plant species.	4	3.63	0.87
218	The ability to trap wildlife.	4	3.63	0.91
219	To have basic knowledge of agronomy (soil characteristics, identification, and productivity).	4	3.63	0.91
220	The ability to identify, classify, and compare plant communities by implementing plant surveying and mapping techniques (e.g. Daubenmire habitat method).	3.5	3.63	0.94
221	The ability to key-out vertebrate species.	3.5	3.63	1.01
222	The ability to understand the structure and function of state agency administrations.	4	3.63	1.04
223	The ability to identify key governmental administrators that formulate wildlife policy.	4	3.63	1.07
224	To have basic camping and outdoor survival skills.	4	3.63	1.07
225	The ability to apply sensitivity training in the workplace.	4	3.63	1.10
226	The ability to apply basic budgeting and accounting skills in the workplace.	3.5	3.59	0.84
227	The ability to identify non-wetland and wetland soil types by soil characteristics, soil maps, and imagery.	4	3.59	0.98
228	The ability to use scientific journal writings to develop a theoretical approach to problem solving.	4	3.59	1.04
229	To have knowledge of different types of hunting equipment.	4	3.59	1.04
230	The ability to identify, sex, and age waterfowl.	4	3.59	1.07
231	To have knowledge of the life history requirements for various migratory birds.	4	3.56	0.76

232	The ability to understand and apply human social, demographic, economic, and political implications as to related wildlife law, sustainable resources, management, harvest, conservation, preservation, and assessment.	3	3.56	0.84
233	The ability to implement population-adaptive harvest management techniques.	4	3.56	0.91
234	To have knowledge of spatial and temporal landscape analysis.	4	3.56	0.98
235	The ability to use current methods of plant eradication to control invasive exotic species for habitat restoration and management.	4	3.56	1.05
236	To be knowledgeable of white-tailed deer management techniques.	4	3.53	0.84
237	To understand the relationship between soil type, soil fertility, soil hydrology, and plant community to assess ecosystem cycling, productivity, and distribution.	3	3.53	0.88
238	The ability to plan, implement, and assess the findings of random transect sampling.	3	3.53	0.88
239	To recognize and understand the relationship between climate and ecosystems.	4	3.53	0.95
240	To know the agencies and CEO's that affect state and federal wildlife programs.	3	3.53	1.05
241	The ability to follow basic laboratory procedures.	3.5	3.53	1.08
242	The ability to use marketing principles and effectively communicate ideas through educational and awareness programs to stakeholders.	4	3.53	1.11
243	The ability to effectively manage relationships with lessees (e.g. hunting clubs).	3	3.53	1.24

244	The ability to statistically analyze population data to determine population growth and recruitment potential.	3	3.50	0.84
245	The ability to estimate animal populations by ground transects.	3	3.50	0.84
246	The ability to implement and assess prescribed fire for habitat restoration and management.	3.5	3.50	0.88
247	The ability to key-out a mammal species.	3	3.50	1.02
248	To have knowledge of forest management with emphasis on hardwood management.	3.5	3.50	1.16
249	To develop critical quantitative thinking skills by completing math courses through college trigonometry.	4	3.50	1.16
250	To have knowledge of the life history requirements for waterfowl.	4	3.47	0.92
251	The ability to understand diverse wildlife values and use that information to design and implement environmental education and/or outreach programs.	3	3.47	0.92
252	To be familiar with global historic and contemporary wildlife issues.	3.5	3.47	0.92
253	To have knowledge of political science.	3	3.47	0.95
254	The ability to understand the assumptions of parametric and non-parametric statistics.	3.5	3.47	0.98
255	The ability to identify all plants and plant communities within a sampling point.	3	3.44	0.67
256	The ability to plan, implement, and assess the findings of a plot transect survey.	3	3.44	0.84
257	To understand and recognize the relationships between geology and ecosystems of the work area, district and region.	3	3.44	0.95
258	The ability to understand historical and contemporary roles of society in forest management.	3	3.44	0.98

259	The ability to implement water level management strategies for habitat restoration and management.	3	3.44	1.01
260	To have an understanding of range ecology and management principles.	3	3.44	1.19
261	The ability to operate an ATV as indicated by training certification.	4	3.44	1.24
262	The ability to implement risk assessments for "species at risk."	3	3.41	0.71
263	The ability to plan, implement, and assess the findings of a point-center plot survey.	3	3.41	0.8
264	The ability to implement survey techniques for migratory neotropical birds.	3	3.41	0.91
265	The ability to age various wildlife species by locating and implementing species-specific techniques.	3	3.41	0.95
266	To understand the relationships between geography and ecosystems.	3	3.41	0.95
267	The ability to use timber inventory sampling techniques that are commonly used in modern forest management.	3	3.41	0.95
268	To be familiar with various radio telemetry techniques.	3	3.41	0.98
269	To be first aid and CPR qualified.	3	3.41	1.24
270	The ability to apply macro and microeconomics concepts to wildlife management.	3	3.38	0.71
271	The ability to plan, implement, and assess a belt-line transect sampling design.	3	3.38	0.79
272	The ability to perform routine service and emergency repair of vehicles and equipment.	3	3.38	0.91
273	The ability to plan, implement, and assess the findings of a browse survey.	3	3.38	0.98
274	To have knowledge of coniferous ecosystems.	3.5	3.38	1.1
275	To develop critical quantitative thinking skills by completing math courses through college calculus.	4	3.38	1.21

276	The ability to use, develop, or adapt habitat suitability index models to estimate habitat quality and potential.	3	3.34	0.83
277	The ability to identify, sex, and age neotropical birds.	3	3.34	0.90
278	The ability to apply basic knowledge of business administration and management in the workplace.	3	3.34	0.90
279	The ability to conduct waterfowl surveys utilizing current technology.	3	3.34	0.94
280	The ability to use soil type and topography to assess the hydrologic regime.	3	3.34	1.07
281	The ability to speak with the media and get your most important message across in a 30 second sound bite.	3	3.34	1.18
282	To have knowledge of the factors affecting plant growth, reproduction, fitness, and survival including knowledge of diseases and genetics.	3	3.31	0.93
283	To recognize and understand the relationship between regionalized weather patterns (daily, seasonal, and long-term patterns) and weather impacts on wildlife.	3	3.31	0.93
284	To have basic knowledge in law enforcement and the wildlife agent's duties.	3	3.31	0.93
285	The ability to conduct deer surveys using current technology.	3	3.31	0.97
286	To have knowledge of wildlife damage management principles.	3	3.31	1.06
287	The ability to use a winch on a vehicle.	3	3.31	1.12
288	To have a basic knowledge of herpetology.	3	3.28	0.63
289	To have knowledge of fish biology and management.	3	3.28	0.96
290	To have basic knowledge and use of various farm equipment and implements.	3	3.28	1.02

291	To be able to read and understand reports that utilize advanced statistical concepts (ANCOVA, Logistic Regression, etc.)	3	3.28	1.22
292	The ability to operate a motorized boat as indicated by training certification.	3	3.28	1.28
293	To have basic knowledge of mammalian reproductive physiology.	3	3.25	0.84
294	The ability to operate hand-held computers.	3	3.25	0.88
295	To have basic knowledge of mammalian anatomy.	3	3.25	0.92
296	The ability to estimate animal populations by aerial transects.	3	3.25	0.92
297	To have basic knowledge of avian reproductive physiology.	3	3.25	0.95
298	The ability to identify animal sign for animal damage control assessment.	3	3.25	0.98
299	To have basic knowledge of water rights law.	3	3.25	1.08
300	The ability to implement and manage moist soil unit plant productivity.	3	3.25	1.16
301	To have knowledge of basic water quality monitoring techniques.	3	3.22	0.87
302	The ability to manage the soil for improved environmental and economic productivity.	3	3.22	0.91
303	The ability to document information via camera operation.	3	3.22	0.97
304	The ability to implement waterfowl surveys.	3	3.22	1.13
305	To have a practical understanding of meteorology.	3	3.22	1.13
306	The ability to identify soil types and characteristics within a sampling point.	3	3.19	0.82
307	To recognize and understand the relationship between elevation and ecosystem diversity.	3	3.19	0.86
308	The ability to effectively manage prescribed fire to protect air quality.	3	3.19	0.90
309	To understand the basic principles of plant physiology.	3	3.19	0.93

310	The ability to plan, implement, and assess the findings of a public opinion survey (questionnaires).	3	3.19	0.97
311	The ability to understand the basics of fire and fire fighting (wildland fire training/certification: Federal s130/190).	3	3.19	0.97
312	The ability to implement survey techniques for members of the Cervidae family.	3	3.19	1.03
313	The ability to map and inventory a watershed.	3	3.19	1.06
314	To have knowledge of different types of fishing equipment.	3	3.19	1.06
315	The ability to age deer by dental wear.	3	3.19	1.09
316	The ability to formulate public use regulations.	3	3.19	1.12
317	The ability to manage greentree and moist soil units for target species and species diversity.	3	3.16	1.08
318	The ability to identify, locate, implement, and assess site-specific controls for non-point source pollution to improve water quality.	3	3.16	1.14
319	The ability to use basic land surveying techniques (e.g. shooting elevations, determining boundaries, setting grade, road construction, logging systems).	3	3.16	1.42
320	To have knowledge of the effects of disease on wildlife growth, reproduction, fitness, and survival.	3	3.13	0.79
321	The ability to use surface soils, sub-surface soils, and topography information to assess surface water retention, ground water components, and hydrologic cycles for wildlife management planning.	3	3.13	0.94
322	To have knowledge of grassland/rangeland inventory techniques.	3	3.13	0.98

323	To have basic knowledge and basic abilities to use hand tools for carpentry, electrical, plumbing, metal fabrication, and general maintenance.	3	3.13	1.1
324	To have knowledge of major case histories involving controversial resource issues such as the Monogahela decision, Everglades, Columbia River dams, Chesapeake Bay pesticides, Northwest old growth forests and Northwest Forest Plan by the Clinton Administration.	3	3.09	0.93
325	To have knowledge of shorebird management techniques.	3	3.09	1.17
326	The ability to apply classification and ordination statistics to determine ecological groupings and gradients.	3	3.06	0.95
327	To have knowledge of shorebird life history.	3	3.06	1.01
328	To have knowledge of silvicultural biometrics.	3	3.03	0.93
329	The ability to determine and identify species-specific agricultural depredation potentials.	3	3.03	1.00
330	To be able to read and understand complex research designs.	3	3.03	1.06
331	To have the basic knowledge of organic chemistry.	3	3.03	1.09
332	The ability to communicate by radio.	3	3.03	1.23
333	To have basic knowledge of avian anatomy.	3	3.00	0.80
334	The ability to conduct shorebird surveys using current technology.	3	3.00	1.02
335	The ability to identify, locate, implement, and assess site-specific controls for non-point source pollution to improve water quality.	3	3.00	1.08
336	The ability to understand a soil analysis and determine fertilizer and lime recommendations.	3	3.00	1.14
337	The ability to reference legal codes that provide the mandate for agency administration and operation.	3	3.00	1.27

338	To have knowledge of the effects of genetics on wildlife growth, reproduction, fitness, and survival.	3	2.97	0.78
339	To develop critical quantitative thinking skills by completing college physics.	3	2.97	1.12
340	The ability to understand risk analysis and management.	3	2.94	0.95
341	The ability to safely operate a chainsaw and properly fell a tree.	3	2.94	1.16
342	The ability to write grants.	3	2.91	0.96
343	The ability to read and follow blueprints and shop drawings.	3	2.91	1.03
344	The ability to implement survey techniques for shorebirds.	3	2.91	1.23
345	The ability to apply wildfire risk assessment models to "species at risk."	3	2.88	0.91
346	To have knowledge of water chemistry and water quality sampling methods.	3	2.88	0.94
347	The ability to key-out invertebrate species.	3	2.88	1.18
348	To be defensive driving certified.	3	2.88	1.21
349	To have basic knowledge of construction.	3	2.88	1.24
350	The ability to implement a species-specific population viability analysis.	3	2.84	0.81
351	To be familiar with SAS (Statistical Analysis System).	3	2.84	0.88
352	To have the basic knowledge of inorganic chemistry.	3	2.84	1.02
353	The ability to identify signs and symptoms of common wildlife diseases.	3	2.81	0.78
354	To have basic knowledge of mammalian physiology.	3	2.81	0.78
355	The ability to determine the suitability of land for agronomic production.	3	2.81	1.00
356	To have an understanding of modern genetic approaches in wildlife conservation.	3	2.78	0.61
357	To have basic knowledge of avian physiology.	3	2.78	0.71

358	To have a basic knowledge of physical and organic chemistry to aid with chemical applications (fertilizer, herbicides, and pesticides).	3	2.78	0.87
359	To have basic knowledge of the taxonomy of spermatophytes.	3	2.78	1.16
360	The ability to perform basic necropsy procedures and protocol, which include sample collection and tissue storage.	2.5	2.75	1.08
361	The ability to administer proper animal care through animal husbandry techniques and contemporary knowledge of animal welfare issues.	2	2.75	1.14
362	To have a basic knowledge of entomology with emphasis in aquatic insects and tree damaging pathogens.	3	2.72	0.73
363	The ability to conduct mourning dove surveys using current technology.	3	2.72	1.02
364	The ability to use inferential statistics to estimate home range.	2.5	2.69	1.00
365	The ability to conduct rail surveys using current technology.	3	2.69	1.06
366	The ability to conduct woodcock surveys using current technology.	3	2.66	1.00
367	The ability to monitor water quality using direct and remote automated equipment for wildlife management planning.	3	2.63	0.91
368	The ability to use basic meteorological monitoring equipment and apply meteorological data for wildlife management planning.	2	2.63	0.94
369	The ability to monitor and interpret basic soil and water models to estimate sediment yield, water quality, and water heating.	2	2.59	1.07
370	To have knowledge of organic and biochemistry with specific information on toxicology and environmental health.	2	2.56	0.84
371	To have basic knowledge and use of heavy equipment.	2	2.50	1.14

372	To have knowledge of agrostology for the study of grasses and grassland habitat management.	2	2.44	0.56
373	The ability to implement variable-plot tree cruising using a Relaskop instrument.	2	2.44	0.95
374	To have knowledge of animal evolution, which includes ecological, genetic and molecular techniques.	2	2.41	0.91
375	To have basic knowledge of business law.	2	2.41	1.01
376	The ability to assess and implement irrigation techniques for land use.	2	2.34	1.1
377	To have knowledge of plant evolution, which includes ecological, genetic and molecular techniques.	2	2.25	0.8
378	The basic ability for repair and maintenance of computers (troubleshooting for repair and maintenance).	2	2.22	0.75
379	To have experience in small aircraft and helicopters	2	2.19	0.82
380	To have experience in fish shocking equipment.	2	2.06	0.91
381	To have experience with wetsuits/snorkeling.	2	1.97	1.00
382	The ability to fabricate metal (welding/cutting operations).	2	1.81	0.82

Note. Mean ratings were classified according to the following interpretive scale: 5.00 – 4.50 = high importance; 4.49 – 3.50 = substantial importance; 3.49 – 2.50 = moderate importance; 2.49 – 1.50 = low importance; and 1.49 – 1.00 = no importance.
[a]Median of ratings assigned by Delphi Panelists.
[b]Mean rating based on following anchored scale: 5 = high importance; 4 = substantial importance; 3 = moderate importance; 2 = low importance; and 1 = no importance.

APPENDIX V

DELPHI PANELIST COMMENTS

1. Panelist, "Sorry Billy. Attached is the revised document with (hopefully) all lines filled out. This research may be more painful for you than a quail transect through a blackberry thicket."
2. Panelist, "Hi Billy-I worked in completing this information this AM (Saturday). Please let me know if this still shows as incomplete. Sorry for taking extra time."
3. Panelist, "Sorry for the delay. I have been out of the office for two weeks. I am actually in the middle of responding to the request. I should have it completed in a few minutes. Thanks."
4. Panelist, "Bill - I have completed the final four instruments. Let me know if I can be of further assistance. Sorry about the delay - other imposed priorities prevented a more rapid response."
5. Panelist, "Billy, I finished these this afternoon. Have been out of state for the last 4 days."
6. Panelist, "Billy-- Sorry for the late response, I didn't see that I received the survey on Friday and thought that I had to this Friday."
7. Panelist, "Billy, Thanks for the extension. I was able to get into the survey now. Sorry for the delay."
8. Panelist, "Dear Billy: In my opinion, you have too many statements and YOU need to reduce them down to common statements. I do not have the time to go through them all when many are the same." Panel facilitator (Billy), "Dear ______, I understand your concern, and I realize that there is considerable material to review. Please bear with me and understand the needs of this study. Yes, there are generalities among items.

However, the Delphi process requires that items, while similar in nature must remain unique (even if minutely so). If the Delphi coordinator over-generalizes, then he or she is making decisions which may reduce or lose the individual panelist's idea, which results in the lost of data. Your fellow panel members are employed nationwide in the academic, private, and public sectors. There will be agreement and disagreement issues among panelists, which is why the panel members are anonymous to each other and confidential to the coordinator. The concept is to gather this descriptive data and complete this study. Afterwards, there will be follow-up research to synthesize and reduce to common denominators, which I do agree with you is necessary for the data to be pragmatically utilized for the educational process. I do realize that your time is valuable. Your time is also valuable to this study. Your experience should be a part of this study. Attached for your convenience are the 8 instruments. The instruments are in Microsoft Word and are form protected. If you will complete each instrument and email back to me, I will enter the data into the database. The final due date is Monday, March 8th at 12pm. Thank you for your assistance in this matter. Sincerely, Billy." Billy: I was able to complete online and send to you. The Word copies helped me to read them all first and then go online. thanks. ______. ______, Thank you for taking the time to provide your experiences. Will be in contact soon with final instrument. Billy

9. Panelist, "Billy - Job has been completed. As I went back through the surveys, I again noted that most of my low ratings in the second round were because of what I interpreted to be redundancy. My thinking was, for example, if a person knew plant ecology, they would also be able to identify a particular successional stage, and so rated the latter much lower than the former. Apparently, others didn't agree. Therefore, I went back and

considered each item independently of all other responses, and ended up changing most. Hope this helps some."

10. Panelist, "Thanks Billy, I have gone through and either changed my ranking on the yellow ones or provided an explanation as to why I didn't feel it was appropriate to change my ranking and submitted it. One question, I assume we are going to be able to obtain a copy of this analysis when you have compiled it, and I sure would like to have it when you have completed it. The primary reason is that I am a member of the Steering Committee for planning the upcoming 70th North American Wildlife and Natural Resources Conference and will be meeting with the other committee members the last couple of days in April and first couple of days in May in WVA to plan the various Special Sessions and I think a revised look at the changing educational needs of wildlife biologists and the leadership changes in natural resource agencies are coming together at a time when many agencies are observing the changes peripherally. However, they don't really know how to deal with how these changes will influence the effectiveness and the culture in their agencies. I suspect I will propose a Special Session similar to the one we had at this conference in 2000, but title it differently and approach it from a slightly different perspective. This data you are collecting will make an excellent presentation at this session if I can convince the rest of the committee that it is both important and timely. If you have any thoughts on this or suggested titles, please let me know before the end of next month. I think I leave to go to the meeting on April 26."
11. Panelist, "Billy, I've completed round three but I also want to call your attention to another detail worth considering as you develop course work in this field. The Office of Personnel Management (OPM) determines the minimum courses required for each job classification/series. For example, to be eligible for an entry level job as a refuge

manager (GS-485) or refuge biologist (GS-486), OPM may require a minimum of 12 college hours of botany or related courses (and they also determine which courses are acceptable related ones). If the required courses for a degree in the field only require eight hours in botany, a graduate may find himself with a degree and yet not eligible for entry level positions in his chosen field with the U. S. Fish and Wildlife Service. Required courses need to at least include the minimum for entry level positions with our agency. If you want to check further on this, I would recommend that you talk with ____ ____ who is in charge of out SCEP and other programs, which bring college students into the refuge program. _____ has ran into this issue several times at various institutions and found their students ineligible for future employment due to college course work not meeting OPM criteria. I'm not sure but he may also be working with OPM to revise the required coursework for certain job series. Anyway, if you want to contact him, he is in the USFWS regional office in Atlanta. His phone # is ______."

12. Panel facilitator, "Dear ____, I am honored. Thank you. The analysis of this data is descriptive and only requires the ordering of means and sd. The Delphi Panel was a purposeful sample and does not lend itself to inferential analysis. Follow-up research will be to refine the items into more centralized job skills. For instance, there are several items concerning plant identification. These items will be reviewed and developed into one item. Once this process is complete for all the items, the intentions are to create statistically testable instrument that can be administered randomly to among the different work groups (academics, private, and public). I will provide a copy of the job skills list for you, and I will publish in the Wildlife Society Bulletin. However, I would be pleased and honored (if the opportunity comes available) to present at the 70th North American. The title of this work is "Entry-level job skills needed by wildlife management

professionals. While the purpose is to develop a list of skills that can be incorporated into higher learning, I hope that students will be invigorated to learn more by embedding futuristic job skills into academic learning. Of course, this is merely updating the hands-on learning needs that have long been a part of our profession. I went on the internet. Is the information on the 70th correct? March 16-20, 2005. 70th North American Wildlife & Natural Resources Conference Crystal Gateway Marriott, Crystal City, Virginia. Thank you, Billy." Panelist, "Yes Billy, that is correct, the 70th North American will be in the D.C. area as it is usually every four years in an election year. I appreciate your providing the information and I will be trying to convince the other committee members when we meet next month that it is time for a special session on the changes in the profession, from what students need to know, to what agencies need to understand, to how agencies and other employers of wildlife professionals need to make changes to provide more mentoring and orientation for new employees, to a reality check of what the expectations of agencies and new wildlife professionals are in the future. If I am convincing enough to get the other members to buy in I will keep you informed and if you are interested in submitting an abstract for such a session, I will let you know who the chair or co-chairs of the session are."

13. Panelist, "Professor Delany ... A well-designed survey to facilitate input to better develop curricula for future wildlife managers ... interesting in that I surprised even myself at the high importance I placed on the "people" side of our business ... thanks for giving me the opportunity to participate ..."
14. Panelist, "Just completed the round one instrument. Thank you for the opportunity."
15. Panelist, "Good luck with your endeavor to improve the college course work for this field. Hope my participation was helpful."

16. Panelist, “Hi fellow, looks like it's shaping up. I am interested in the final report. Good luck.”
17. Panelist, “Why do you back up your box so well? Something really taught you well. Data Losses and close calls have taught me about back ups. Glad you saved it. Good luck.”
18. Panelist, “Thanks for your phone call today Billy, and for all your work on this.”
19. Panelist, “Billy: You and a cup of coffee greet me this morning. At least I will switch to decaf....”

VITA

Billy Warren DeLany, Jr. was born in Jackson, Mississippi, on July 30, 1957. He graduated from South Cameron High School in May of 1975. He entered the U.S. Marine Corps in June of 1975 and was honorably discharged in August of 1979 as a Sergeant. In 1983, he received his Bachelor of Science in wildlife management from McNeese State University with honors (Magna cum Laude; GPA = 3.79). In December 1985, he received his Master of Science in wildlife management from the Louisiana State University, School of Forestry, Wildlife, and Fisheries. In August 2004, he will receive his Doctor of Philosophy in agricultural, adult, extension, and international leadership from the Louisiana State University School of Human Resource Education and Workforce Development. His lifetime college grade point average was 3.79.

His professional work experiences include employment by the U.S. Fisheries and Wildlife Service at Sabine National Wildlife Refuge as a biologist, assistant refuge manager, and law enforcement agent, Miami Corporation natural resource manager over 250,000 acres of coastal Louisiana marsh, private wetlands consultant for Simon & DeLany, L.L.C., and wildlife management assistant professor in charge of the wildlife curriculum for McNeese State University.

Billy, his wife Denise, and their two daughters Arden and Ali live in Lake Charles, Louisiana.